



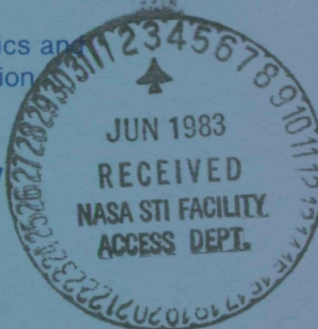
Aeronautical
Engineering
A Continuing
Bibliography
with Indexes

NASA SP-7037(161)
May 1983

National Aeronautics and
Space Administration



25th Anniversary
1958-1983



(NASA-SP-7037(161)) AERONAUTICAL ENGINEERING: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 161) (National Aeronautics and Space Administration) 105 p HC A06 N83-25651 Unclas CSCI 01A 00/01 11833

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Accession numbers cited in this Supplement fall within the following ranges.

STAR (N-10000 Series)

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AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

(Supplement 161)

A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in April 1983 in

- *Scientific and Technical Aerospace Reports (STAR)*
- *International Aerospace Abstracts (IAA).*



Scientific and Technical Information Branch 1983
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INTRODUCTION

Under the terms of an interagency agreement with the Federal Aviation Administration this publication has been prepared by the National Aeronautics and Space Administration for the joint use of both agencies and the scientific and technical community concerned with the field of aeronautical engineering. The first issue of this bibliography was published in September 1970 and the first supplement in January 1971.

This supplement to *Aeronautical Engineering -- A Continuing Bibliography* (NASA SP-7037) lists 375 reports, journal articles, and other documents originally announced in April 1983 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*.

The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles.

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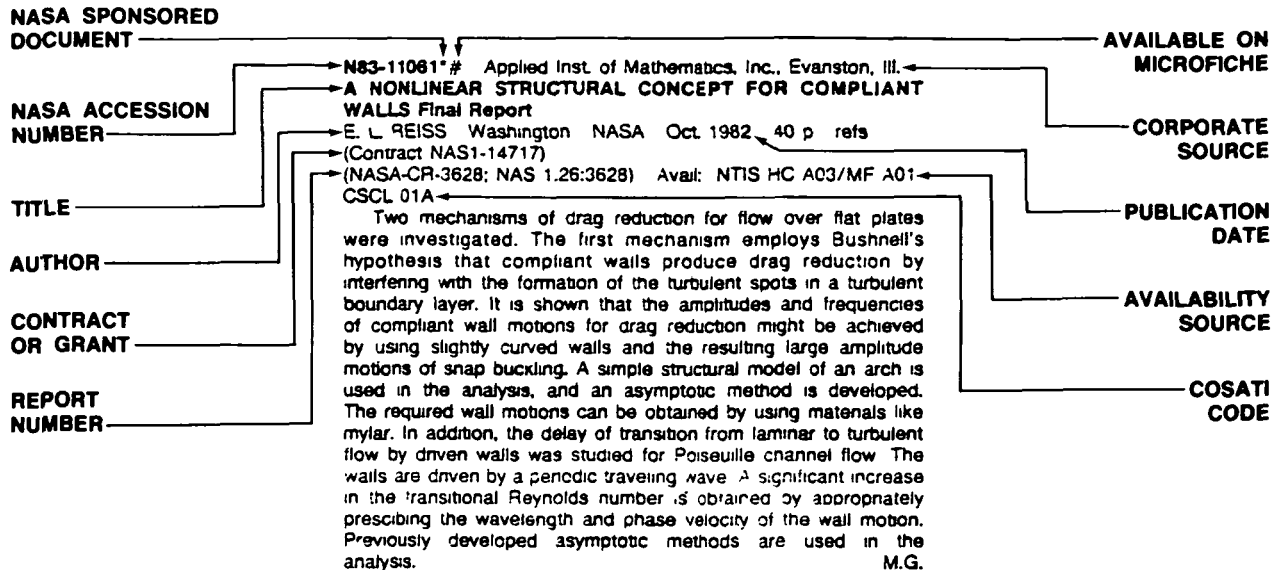
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TABLE OF CONTENTS

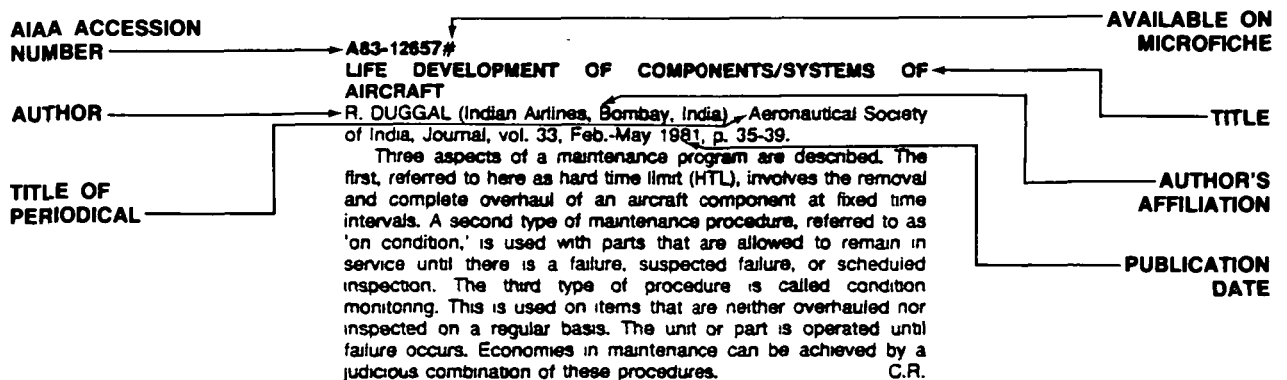
	Page
Category 01 Aeronautics (General)	185
Category 02 Aerodynamics Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.	188
Category 03 Air Transportation and Safety Includes passenger and cargo air transport operations; and aircraft accidents.	196
Category 04 Aircraft Communications and Navigation Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.	199
Category 05 Aircraft Design, Testing and Performance Includes aircraft simulation technology.	202
Category 06 Aircraft Instrumentation Includes cockpit and cabin display devices; and flight instruments.	208
Category 07 Aircraft Propulsion and Power Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.	210
Category 08 Aircraft Stability and Control Includes aircraft handling qualities; piloting; flight controls; and autopilots.	215
Category 09 Research and Support Facilities (Air) Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.	217
Category 10 Astronautics Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.	221
Category 11 Chemistry and Materials Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.	222

Category 12 Engineering	228
Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.	
Category 13 Geosciences	234
Includes geosciences (general); earth resources; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.	
Category 14 Life Sciences	N.A.
Includes sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and planetary biology.	
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Category 16 Physics	237
Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.	
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Personal Author Index	B-1
Corporate Source Index	C-1
Contract Number Index	D-1
Report Number Index	E-1
Accession Number Index	F-1

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AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 161)

MAY 1983

01

AERONAUTICS (GENERAL)

A83-20381

**FABRICATION TECHNOLOGY FOR AIRCRAFT ENGINES
[TEKHNOLOGIJA PROIZVODSTVA DVIGATELEI
LETATEL'NYKH APPARATOV]**

M. I. EVSTIGNEEV, A. V. PODZEL, and A. M. SULIMA Moscow, Izdatel'stvo Mashinostroenie, 1982. 264 p. In Russian. refs

The principles underlying the development of fabrication processes for aircraft engines are examined. Particular consideration is given to processing precision, tolerances and operating dimensions, machine-working principles, computer-aided manufacturing techniques, methods for enhancing the reliability and service life of engine parts, and mathematical modeling and optimization methods. Surface-finishing methods are also considered, with attention given to various finishing methods (electrochemical, ultrasonic, etc.), the finishing of apertures, and the finishing of flat and shaped surfaces. B.J.

A83-20432

**A SENSIBLE APPROACH TO PROCESS CONTROL OF
ADHESIVE BONDING**

G. CARRILLO (Rohr Industries, Inc., Riverside, CA) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 53-62.

It is pointed out that the most common method used for the determination of the integrity of bonded assemblies includes the use of process control test panels. The present investigation is concerned with the use of process control test panels in connection with the evaluation of bonded assemblies. A suitable process control procedure is proposed, taking into account surface preparation techniques, the control of the adhesive materials, the standardization of process control panel configurations and requirements, the Tensile Lap Shear Test, wedge crack propagation, the Honeycomb Climbing Drum Peel Test, Metal to Metal Climbing Drum Peel, and face tension. Aspects of process evaluation and level description are discussed. Attention is given to adhesive film control, adhesive manufacturing control, receiving inspection, and adhesive cure. G.R.

A83-20478

AIRCRAFT INSPECTION USING RADIOGRAPHY

J. D. QUARLES (Pacific Southwest Airlines, San Diego, CA) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 763-768.

According to the regulations of the Federal Aviation Administration the owner of an aircraft has to provide a periodic and systematic inspection program which covers all external and internal surfaces of the aircraft. It is pointed out that, in particular, the visual internal inspection of the aircraft is very time consuming. The amount of work connected with this inspection can be greatly

reduced by utilizing a procedure involving the radiographic inspection of structural areas. Under the radiographic inspection concept, each inspection task is an identifiable operation. Each area to be X-rayed is clearly defined, and the purpose of the inspection is also stated so that any negative condition can be easily detected. The maintenance program is discussed, taking into account predocking, docking, and prephase tasks. Attention is also given to airworthiness directives, the radiographic inspection of engines, and special maintenance documents. G.R.

A83-20479

**SERVICE HISTORY OF PHOSPHORIC ACID ANODIZED
ALUMINUM STRUCTURE**

D. B. ARNOLD and C. S. CARTER (Boeing Commercial Airplane Co., Seattle, WA) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 769-776.

Adhesive-bonded aluminum structure was first used for aircraft construction applications in the 1940's. The newest aircraft of an American aerospace company retain large amounts of bonding complemented by graphite-epoxy structure on many control surfaces. In the past there have been problems with corrosion and delamination of bonded components. However, these problems were overcome with the aid of new technological developments. It is pointed out that aircraft assemblies bonded with new-technology methods and delivered since 1974 have experienced a very low failure rate. No corrosion has been reported and delamination cases are attributed to foreign-object damage, thermal damage or poor subcontractor control. The most important change undertaken to overcome the previous problems is related to the implementation of optimized FPL etching and subsequently of phosphoric-acid-anodized prebond surface treatments. G.R.

A83-20480

**SERVICEABILITY EVALUATION OF ADVANCED COMPOSITE
F-14A MAIN-LANDING-GEAR-STRUT DOORS AND OVERWING
FAIRINGS**

J. MAHON (Grumman Aerospace Corp., Bethpage, NY) and M. LIBESKIND (U.S. Naval Air Development Center, Warminster, PA) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 777-796. Navy-supported research.

Five ship-sets of advanced composite overwing fairings and nine ship-sets of advanced composite F-14A aircraft main-landing-gear-strut (MLGS) doors were fabricated under Naval Air Development Center contracts. The service durability of advanced composite F-14A MLGS doors and wing fairings is presently being monitored. In support of this effort, damage/acceptance criteria and nondestructive inspection techniques were established for damage anticipated in the operational use of the advanced composite hardware on fleet aircraft. Structural repairs for production-line and operational damage are also being monitored for service durability. A component description is provided, and a number of flight tests is discussed. In connection with a serviceability evaluation, graphite/epoxy MLGS doors were installed on three F-14A aircraft while two aircraft were equipped with composite doors and fairings. G.R.

01 AERONAUTICS (GENERAL)

A83-20485* Northrop Corp., Hawthorne, Calif. **DEMONSTRATION OF REPAIRABILITY AND REPAIR QUALITY ON GRAPHITE/EPOXY STRUCTURAL SUBELEMENTS**

J. F. KNAUSS (Northrop Corp., Aircraft Div., Hawthorne, CA) and R. H. STONE (Lockheed-California Co., Burbank, CA) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 874-885. (Contract NAS1-15269)

The considered program has the objective to develop and validate repair procedures for composite structures which are adaptable to commercial airline maintenance operations. Questions concerning the design and the fabrication of repairs are discussed, taking into account a vertical fin cover panel, a wing cover panel, and a vertical fin spar. The test results indicate that the use of graphite patch repairs, either precured bonded or employing cure-in-place, is satisfactory for the repair of lightly loaded and highly loaded parts. The use of bolted repairs is satisfactory for lightly loaded structural components. The repair of composite substructures can be accomplished using comparable approaches to those evaluated for skin cover repairs in many previous programs. G.R.

A83-20493 **PRIMARY BONDED AIRCRAFT WING CONSTRUCTION**

P. K. NELSON and W. D. SANDERS (Avco Corp., Nashville, TN) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 967-977. refs

It is pointed out that adhesive bonding is a method of joining metal parts which has been used since the days of wooden structure aircraft. Reavey (1981) has described the advantages and disadvantages of Redux 775 when used in hovercraft in a marine environment. The present investigation is concerned with the properties of this adhesive when used in an aircraft production application. A method for metal-to-metal adhesive bonding was investigated 39 years ago in Europe. The adhesive involved was Redux 775. This adhesive is a vinyl phenolic which is composed of a phenolic resin combined with polyvinyl formal or polyvinyl butyral. The properties of the resin are discussed, and a comparison with epoxy adhesive systems is conducted. Redux 775 is used as the adhesive on the BAe 146 jet aircraft. A production sequence regarding the BAe 146 wing is discussed, taking into account machined skin panels and bonding details, glass bead peening, the bond cycle, and postbond tests and inspection. G.R.

A83-20597# **THE FUTURE FOR FIGHTER AIRCRAFT**

D. R. KOZLOWSKI (McDonnell Douglas Corp., St. Louis, MO) AIAA Student Journal, vol. 20, Fall 1982, p. 3-7.

A discussion is presented of the fighter aircraft performance goals, and design possibilities for meeting such goals, that have emerged as a result of recent advancements in propulsion systems, flight control electronics, guided missiles, and aerodynamics. Attention is given to the integration of these advancements to form vectored thrust supersonic cruise V/STOL and six-degrees-of-freedom configurations, electronic diagnostics for longer service life engines and airframes, and advanced graphic displays for target acquisition and fire control. O.C.

A83-20646# **B-52 ROLES IN SEA CONTROL**

B. G. NIX (Boeing Military Airplane Co., Wichita, KS) Astronautics and Aeronautics, vol. 21, Feb. 1983, p. 42-46.

A recommendation that B-52s be equipped with antiship missiles and committed to naval arenas to compensate for the inability of the Navy to patrol the entire world ocean is presented. The shift of mission would take place as B-1 bombers are brought into service. A U.S. presence in any troubled area would then be possible within 24 hr, rather than three days, of any outbreak. Time would be gained for a rapid deployment force and/or a carrier group to reach the scene. Each B-52 can carry 20 antiship

missiles and perform missions such as ship escort, armed reconnaissance, sea-land protection, ocean blockade, and ship attack. Long-range sensing and launch of stand-off weapons is possible for the B-52. Attention is given to the problem of ship identification, in order to avoid attacks on friendly craft. D.H.K.

A83-21001 **ISRAEL ANNUAL CONFERENCE ON AVIATION AND ASTRONAUTICS, 24TH, TEL AVIV AND HAIFA, ISRAEL, FEBRUARY 17, 18, 1982, COLLECTION OF PAPERS**

Conference supported by the Technion - Israel Institute of Technology, Ministry of Defence of Israel, Israel Aircraft Industries, et al. Haifa, Technion - Israel Institute of Technology, 1982. 253 p.

Various topics in aerodynamics are discussed. The subjects considered include: automation of onboard flight management; leading edge vortex flap aerodynamics; effective aerodynamic parameter evaluation from free flight tests; constrained eigenvalue/eigenvector assignment - application to flight control systems; theoretical stiffness matrix correction by using static test results; turbulence model to predict heat transfer correlations; development of a radial diffuser with boundary layer control; capture region of a coasting pursuer; aerodynamics of wrap-around fins; numerical methods of subsonic lifting surface theory. Also addressed are: slurry fuel performance for ramjet prediction of aerodynamic loads on helicopter blades using lifting line theory; aeroelastic behavior of curved helicopter blades; 2-D coordinate grid generation by a vortex singularity method; suboptimal filters for INS alignment on a moving base; new square root filtering algorithm; supersonic maneuvers without superbooms; transonic flow calculations by a finite element method; curved lifting-line theory for thin planar wings; dynamics of air combat. C.D.

A83-22574 **UNITED STATES AIR FORCE TACTICAL RECONNAISSANCE - AN ANALYSIS AND COMMENTARY**

R. E. REAMER (USAF, Tactical Air Command, Langley AFB, VA) In: Airborne reconnaissance V; Proceedings of the Seminar, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1981, p. 2-8.

A83-22575 **ADVANCED TACTICAL AIR RECONNAISSANCE SYSTEM**

D. W. MONTGOMERY (USAF, Washington, DC) In: Airborne reconnaissance V; Proceedings of the Seminar, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1981, p. 9-12.

The factors which have influenced the tactical reconnaissance needs of the Air Force are examined, and the present status of the Advanced Tactical Air Reconnaissance System (ATARS) is discussed. The basic need is for near-real-time tactical targeting information under all weather and light conditions using a survivable platform responsive to the tasking of the tactical commander. The system should include the capability to operate as a deployable system and to be more logistically supportable than existing systems. These needs will be addressed by a number of new systems, such as the Advanced Synthetic Aperture Radar, other TR sensors, the Precision Location and Strike System, and the PAVE MOVER radar system; the candidate platforms include derivatives of existing fighter-type aircraft, unmanned systems, and other developments. The near-real-time requirement also implies the use of a data link to relay critical information to selected ground sites. Finally, the logistics and support as well as ground site requirements are examined. V.L.

A83-22577 **RECONNAISSANCE OF THE YEAR 2000 AND BEYOND**

M. M. DRESSER (VERAC, Inc., San Diego, CA) In: Airborne reconnaissance V; Proceedings of the Seminar, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1981, p. 20-23.

The traditional concepts of reconnaissance and the historical development of reconnaissance systems are briefly reviewed, and

an attempt is made to identify how future reconnaissance systems may be impacted by emerging and advanced technologies. These include high-density multispectral focal plane arrays, new radar techniques, VLSI/VHSIC computational resources, artificial intelligence, multisensor integration, pattern and target recognition, image compression, advanced display and targeting techniques, and even new fields not thought of as exact sciences today (e.g., extrasensory perception). It is pointed out that the classical five stages of the reconnaissance process, i.e., collection, processing, interpretation, reporting, and dissemination, tend to be integrated into two basic functions: Reconnaissance Data Acquisition and Reconnaissance Data Management. V.L.

N83-16280# Tuskegee Inst., Ala. School of Engineering
THREE COMPUTER BASED AIDS TO MAINTENANCE SCHEDULING Final Report, 30 Jun. 1981 - 23 Mar. 1982
A. HARGROVE 13 Sep. 1982 26 p refs
(Contract AF-AFOSR-0168-81; AF PROJ. 2304)
(AD-A120351; AFOSR-82-0874TR) Avail: NTIS HC A03/MF A01 CSCL 15E

The complexity of the scheduling problem is examined including the large numbers of aircraft, the recurring changes of maintenance rules, and the conflict between a desired smooth flow of aircraft into maintenance and the desired flight procedures. Survey of typical schedulers reveals a need to allow a simple operation of a very complex system. Survey of available models reveals Decision Oriented Scheduling System (DOSS) as the most appropriate computer aid. Analysis of DOSS verifies its versatility but reveals the need to simplify it to the level of the average Air Force scheduler's expertise, to further adjust programming statements to a more natural English-like language and to allow for easier and faster programming adjustments due to unscheduled maintenance changes. GRA

N83-16281# Air Force Human Resources Lab., Brooks AFB, Tex. Logistics Research Branch.
COMPUTER BASED MAINTENANCE AIDS SYSTEM: PRELIMINARY DEVELOPMENT AND EVALUATION OF A PROTOTYPE Final Report
D. L. THOMAS Sep. 1982 21 p refs
(Contract AF PROJ. 2362)
(AD-A120627; AFHRL-TP-82-24) Avail: NTIS HC A02/MF A01 CSCL 05I

This technical paper describes work on a project to develop and evaluate a prototype computer based system for storing, retrieving, and presenting technical data for use by maintenance personnel. The work was accomplished under three contracts. Under the first two contracts, the feasibility of developing a computer based system was established and the basic concepts and requirements for the system were developed. Two areas of concern in the development of the system were identified: (1) The need to have the technical data match the skills of the technician and (2) the need to fill the gaps in the individual's knowledge and skills. The problem of making the technical data match the skills of the technician was addressed with the concept of multiple tracks of information. Under this concept, the technical data are developed at three levels of detail for use by highly experienced and novice personnel. The problem of filling the gaps was addressed by the pool concept. Under this concept, the technicians are provided with pools of information which they can call up (e.g., instructions on how to set up test equipment). Under the third contract, preliminary work was accomplished on developing the man/machine interface, presentation formats and system design. GRA

N83-17451*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

OPTIMAL SHORT-RANGE TRAJECTORIES FOR HELICOPTERS

G. L. SLATER (Cincinnati Univ., Ohio) and H. ERZBERGER Dec. 1982 51 p refs
(NASA-TM-84303; A-9132; NAS 1.15:84303) Avail: NTIS HC A04/MF A01 CSCL 01B

An optimal flight path algorithm using a simplified altitude state model and a priori climb cruise descent flight profile was developed and applied to determine minimum fuel and minimum cost trajectories for a helicopter flying a fixed range trajectory. In addition, a method was developed for obtaining a performance model in simplified form which is based on standard flight manual data and which is applicable to the computation of optimal trajectories. The entire performance optimization algorithm is simple enough that on line trajectory optimization is feasible with a relatively small computer. The helicopter model used is the Sikorsky S-61N. The results show that for this vehicle the optimal flight path and optimal cruise altitude can represent a 10% fuel saving on a minimum fuel trajectory. The optimal trajectories show considerable variability because of helicopter weight, ambient winds, and the relative cost trade off between time and fuel. In general, reasonable variations from the optimal velocities and cruise altitudes do not significantly degrade the optimal cost. For fuel optimal trajectories, the optimum cruise altitude varies from the maximum (12,000 ft) to the minimum (0 ft) depending on helicopter weight. S.L.

N83-17452# Office of Science and Technology, Washington, D. C.

AERONAUTICAL RESEARCH AND TECHNOLOGY POLICY. VOLUME 1: SUMMARY REPORT

Nov. 1982 39 p
Avail: NTIS HC A03/MF A01

Policies on aeronautical research and technology (R&T) are reviewed including current and future needs, capabilities, and incentives in both government and private industry. The appropriateness and effectiveness of U.S. aeronautical R&T policies, and the U.S. government's role in support of aeronautical R&T are discussed. The findings and recommendations are presented in the framework of an historical review of government policies and world events that influenced the development of U.S. aeronautics, and the civil competition and military threat resulting from R&D efforts in Europe and in the Soviet Union. It is concluded that significant potential improvement gains exist to warrant future research investment in both government and private industry; U.S. aeronautical facilities are adequate, however continued maintenance, improved productivity, and modernization are required; and procedures to control dissemination of DOD/NASA unclassified aeronautical technology data require further analysis and development. J.M.S.

N83-17454*# Operations Research, Inc., Silver Spring, Md.
RESEARCH AND TECHNOLOGY PROGRAM PERSPECTIVES FOR GENERAL AVIATION AND COMMUTER AIRCRAFT Final Report

J. S. BAUCHSPIES and W. E. SIMPSON Sep. 1982 157 p refs
(Contract NASW-3554)
(NASA-CR-169875; NAS 1.26:169875; TR-2101) Avail: NTIS HC A08/MF A01 CSCL 01B

The uses, benefits, and technology needs of the U.S. general aviation industry were studied in light of growing competition from foreign general aviation manufacturers, especially in the commuter and business jet aircraft markets. Author

01 AERONAUTICS (GENERAL)

N83-17455# Department of Energy, Washington, D. C.
SYMPOSIUM ON COMMERCIAL AVIATION ENERGY CONSERVATION STRATEGIES. PAPERS AND PRESENTATIONS

Apr. 1981 385 p refs Symp. held in Washington, D.C.; 2-3 Apr. 1981 Sponsored in cooperation with FAA (AD-A107106) Avail: NTIS HC A17/MF A01 CSCL 01B

Current and future efforts to conserve fuel and to promote energy conservation within the commercial aviation sector were discussed. Energy conservation programs such as flight operations, air traffic control, engineering and maintenance, and corporate management strategies are included.

N83-17456# Aerospace Corp., El Segundo, Calif.
POTENTIAL FUEL SAVINGS THROUGH IMPROVED AIRFRAME MAINTENANCE

R. R. COVEY, B. M. PERSHING, and R. S. KNIGHT (Continental Airlines) /n DOE Symp. on Com. Aviation Energy Conserv. Strategies p 3-30 Apr. 1981 refs Avail: NTIS HC A17/MF A01 CSCL 01B

Potential fuel savings obtainable through improved airframe maintenance of commercial jet transport aircraft was studied. In the two-task program, one task developed and utilized methods to project analytically the potential improved airframe maintenance-related savings of each aircraft in a fleet of 15 DC-10's. These projections were formulated using a discrepancy data base developed from detailed physical inspections of each aircraft. The second task addressed the verification of fuel savings through the collection and analysis of pre- and post-maintenance flight performance data obtained on two of the DC-10's while in normal revenue service. Based on multivariable linear regression analyses of the flight data, one aircraft showed a decrease in fuel consumption of 0.4 percent at a confidence level in excess of 98 percent, compared to an analytical projection of 0.6 percent. Flight verification results from the second aircraft were inconclusive due to collection of a significant block of data under unstable flight conditions. Author

N83-17462# United Air Lines, Inc., Denver, Colo. Flight Standards and Procedures Dept.

FLIGHT PREPARATION AND PLANNING

B. SCHOOLEY /n DOE Symp. on Com. Aviation Energy Conserv. Strategies p 127-136 Apr. 1981 Avail: NTIS HC A17/MF A01 CSCL 01B

The United Airlines database, from which fuel efficient flight plans are constructed is discussed. N.W.

N83-17465# United Air Lines, Inc., Denver, Colo. Maintenance Operations Div.

COMPUTERIZED ENGINE AND AIRPLANE PERFORMANCE MONITORING PROGRAMS

M. B. SCHWARTZ and A. E. DOMKE /n DOE Symp. on Com. Aviation Energy Conserv. Strategies p 171-208 Apr. 1981 Avail: NTIS HC A17/MF A01 CSCL 01B

Computerized engine and airplane monitoring programs, an important element among the many fuel conservation activities were examined. These systems provide ongoing information on the condition of each individual airplane and the health of the installed engines. Any airplane or engine performance deterioration is apparent and further investigation can be implemented and the necessary action taken. Efforts to audit the effects of performance altering factors are discussed. The Cruise Data Survey System used to measure drag differences between reverser configurations on the 727 airplanes is presented. Long term performance deterioration and the economic unfeasibility of restoring engines and airplanes to new condition are discussed. E.A.K.

N83-17470# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

PREDICTION OF AERODYNAMIC LOADS ON ROTORCRAFT

Sep. 1982 305 p refs In ENGLISH and FRENCH Meeting held in London, 17-18 May 1982 (AGARD-CP-334; ISBN-92-835-0320-1) Avail: NTIS HC A14/MF A01

Advances in rotor airloads prediction methods, including the evolution to the present state of the art, the capabilities and limitations of the current methodology, and the specific areas that need further effort are discussed. Primary emphasis is on the prediction and experimental verification of the steady and unsteady aerodynamic forces on the rotor blades of modern helicopters and related devices, such as wind turbines.

N83-17490# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

HUMAN FACTORS ASPECTS OF AIRCRAFT ACCIDENTS

Oct. 1982 141 p refs In ENGLISH and FRENCH Lectures held in Lisbon, 4-5 Nov. 1982, in Ankara, 8-9 Nov. 1982 and in Athens, 11-12 Nov. 1982 (AGARD-LS-125; ISBN-92-835-0319-7) Avail: NTIS HC A07/MF A01

Human factors engineering and aircraft accidents are discussed.

02

AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

A83-19667

THEORY OF RESISTANCE INTERFERENCE OF AIRFOIL WINGS AND ENGINE EXHAUST [THEORIE DER WIDERSTANDSINTERFERENZ VON TRAGFLUEGEL UND TRIEBWERKSSTRAHL]

G. LOEBERT (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany) Zeitschrift fuer Flugwissenschaften und Weltraumforschung, vol. 6, Nov.-Dec. 1982, p. 433-440. In German. refs

The thrust minus drag aspects of the interference between a wing and a jet discharging into the low pressure field above the wing are analyzed. It is shown that the suction effect of the mixing jet reduces using drag at constant thrust, engine power, and wing lift distribution. The lower the pressure at which the jet mixes with the surrounding stream, the higher is the thrust augmentation. The effectiveness of the concept of low pressure jet mixing is assessed for the cruise condition of transport aircraft. It is shown that with a proper choice of engine location and nozzle shape the thrust augmentation can amount to more than 10% of the net thrust. (Author)

A83-20400#

OPTIMIZATION OF THE SUPERSONIC DRAG OF A SMOOTH WING BY USE OF LINEARIZED POTENTIAL THEORY [OPTIMISATION DE LA TRAINEE SUPERSONIQUE D'UNE AILE PLANE THEORIE DU POTENTIEL LINEAIRE]

P. JUBERT Toulouse III, Universite, Docteur (3e cycle) Thesis, 1981. 143 p. In French. refs

The problem of optimizing the thickness of a wing for supersonic aircraft is modeled analytically. A Hilbert space is formulated for the one- and two-dimensional cases, taking into account the presence of drag, which is considered in terms of Fourier transformations. A finite element method is introduced for obtaining a solution, i. e., an internal approximation, noting the hidden hyperbolic structure of the method. The form of the panels in the finite element program is linked to the flow Mach lines, a technique which necessitates regenerating the grid each time the Mach

number changes, or alterations in the thickness of the modeled wing are introduced. A second grid design method, employing triangular elements, is noted to eliminate oscillations in the wing while costing more to run.
M.S.K.

A83-21016#

PREDICTION OF THE AERODYNAMIC LOADS ON HELICOPTER BLADES IN HOVERING AND AXIAL FLIGHT USING LIFTING LINE THEORY

U. RAND and A. ROSEN (Technion - Israel Institute of Technology, Haifa, Israel) In: Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers. Haifa, Technion - Israel Institute of Technology, 1982, p.117-128. refs

A model where the helicopter blades are replaced by lifting lines, is derived. The model is not a 'free wake' model but it is still a nonlinear one which should be solved iteratively. Features like nonlinear aerodynamic profile properties and blade deformations are included in the model. In addition to the regular case where the angle of attack is calculated at the lifting line, another version, where the angle of attack is calculated at three-quarters of the chord, is also included. The theoretical results are compared with different experimental results which are available from existing literature. In most of the cases the agreement between theoretical and experimental results is good. Different trends are discussed and explained. It is shown that the present model, which is very efficient numerically, may be a very useful tool for calculating the aerodynamic loads.
(Author)

A83-21021#

SUPERSONIC MANEUVERS WITHOUT SUPERBOOMS

H. SCHILLING (Rheinmetall GmbH, Duesseldorf, West Germany) In: Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers. Haifa, Technion - Israel Institute of Technology, 1982, p. 178-183. refs

The paper deals with a new concept to study the occurrence and intensities of sonic booms and focused sonic booms. It is based on a paper by Prandtl (1938) and uses the functional relations between the emission time of a signal from an airplane and the time an observer receives this signal. The derivatives of these relations are shown to be the fundamental quantities for the calculation of the geometric position of the booms on the ground. For two basic maneuvers, inequalities are derived which the flight parameters have to satisfy in order to produce one (or more) superboom(s) on the ground. For simplicity and brevity, only the case of a homogeneous atmosphere is studied; results for a horizontally stratified standard atmosphere are presented only for comparison.
(Author)

A83-21022#

NUMERICAL CALCULATIONS OF NONLINEAR AERODYNAMICS OF WING-BODY CONFIGURATIONS

Z. RUSAK, A. SEGNER, and E. WASSERSTROM (Technion - Israel Institute of Technology, Haifa, Israel) In: Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers. Haifa, Technion - Israel Institute of Technology, 1982, p. 187-197. refs

A numerical method for the calculation of the nonlinear aerodynamic characteristics of wing-body configurations at steady low subsonic flow has been developed. The method is based on a combination of the linear source panel method for the body component and the nonlinear vortex lattice method for the lifting surfaces and their separated wakes. Special emphasis is given to the understanding of the behavior and the computational accuracy of the numerical method. In order to demonstrate the capabilities of the present method, total and distributed loads are computed and compared with available experimental results. The tests cover simple configurations as well as more complicated geometries with greater relevance to modern missiles and aircraft. Details of the calculations clarify the significant nonlinear contribution of the body component to the aerodynamic properties of the configuration. In

all cases which are tested good agreement between the computations and the experiments is found.
(Author)

A83-21024#

CURVED LIFTING-LINE THEORY FOR THIN PLANAR WINGS

J. ASHENBERG and D. WEINS (Technion - Israel Institute of Technology, Haifa, Israel) In: Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers. Haifa, Technion - Israel Institute of Technology, 1982, p. 208-212. refs

The aerodynamic characteristics of planar wings with a curved line of section aerodynamic centers are studied. The analysis deals with incompressible potential steady flow around wings of large aspect-ratio, with spanwise radius of curvature everywhere greater than the local section chord. The curvature is developed as a perturbation of the straight lifting-line. The present approach is thus a direct generalization of Prandtl's lifting-line theory taking account of sweep and curvature. These two effects produce significant changes in the induced velocity is a result of the self-induced velocity on the lifting-line, which is specific to the curved line as well as the induced upwash (or downwash) associated with the sweep. A model for obtaining a consistent estimate for the induced velocity is proposed and numerical results are presented for a lifting-line with parabolic sweep, with both forward and rearward sweep.
(Author)

A83-21080*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AN ANALYTICAL AND EXPERIMENTAL COMPARISON OF THE FLOW FIELD OF AN ADVANCED SWEEP TURBOPROP

H. E. NEUMANN, L. J. BOBER, J. S. SERAFINI (NASA, Lewis Research Center, Cleveland, OH), and L.-K. CHANG (Purdue University, West Lafayette, IN) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 21st, Reno, NV, Jan. 10-13, 1983, 15 p. refs
(AIAA PAPER 83-0189)

(Previously announced in STAR as N83-14061)

A83-22072#

NUMERICAL CALCULATIONS FOR PERFORMANCES OF PROPELLERS IN A STATIC-STATE BY VORTEX THEORY ACCOUNTING OF SLIPSTREAM DEFORMATION AND THEIR COMPARISONS WITH EXPERIMENTS

M. IWASAKI, K. WATANABE, and S. KUBOTA Kyushu University, Technology Reports, vol. 55, Aug. 1982, p. 379-387. In Japanese, with abstract in English. refs

A83-22093#

FUSELAGE-LIFTING SURFACES INTERACTION IN UNSTEADY SUBSONIC FLOW [INTERACTION FUSELAGE-SURFACES PORTANTES EN ECOULEMENT INSTATIONNAIRE SUBSONIQUE]

J. P. ROBERT Toulouse, Conservatoire National des Arts et Metiers, Diplome d'Ingenieur en Aerodynamique Thesis, 1981. 112 p. In French. refs

A numerical model is developed for the flow interactions between a fuselage and a thin wing, and an attempt to extend the theory to cases of complex geometry is presented. Calculations for a thick isolated wing are shown to approach the same solutions as those for a thin wing, in contrast with experimental results from ONERA work with wings of varying leading edges. It is suggested that the disparity is due to the previous exclusion of thickness from the aeroelastic calculations, although the results of the ONERA calculations do approach those that include thickness. The fuselage is found to have a significant effect on the flow past the first few chords of the wing. It is noted that the most complex problem in the determination of a kernel function involves the time duration of the flow structures. An optimized inversion time is developed.
M.S.K.

02 AERODYNAMICS

A83-22132*# Boeing Military Airplane Development, Seattle, Wash.

UNSTEADY TRANSONIC FLOW OVER WINGS INCLUDING INVISCID/VISCOUS INTERACTION

D. P. RIZZETTA and C. J. BORLAND (Boeing Military Airplane Co., Seattle, WA) AIAA Journal, vol. 21, Mar. 1983, p. 363-371. refs

(Contract NAS2-10762)

(Previously cited in issue 07, p. 966, Accession no. A82-19797)

A83-22138*# Pennsylvania State Univ., University Park.

BLADE LOADING AND ROTATION EFFECTS ON COMPRESSOR ROTOR WAKE NEAR END WALLS

B. LAKSHMINARAYANA, T. R. GOVINDAN, and B. REYNOLDS (Pennsylvania State University, University Park, PA) AIAA Journal, vol. 21, Mar. 1983, p. 407-414. refs

(Contract NSG-3012)

(Previously cited in issue 08, p. 1179, Accession no. A82-22063)

A83-22152#

EMBEDDED FLOW CHARACTERISTICS OF SHARP-EDGED RECTANGULAR WINGS

E. S. LARSON (Flygtekniska Forsoksanstalten, Stockholm, Sweden) Journal of Aircraft, vol. 20, Mar. 1983, p. 193, 194. Research supported by the Swedish Air Force. refs

(Previously announced in STAR as N82-29263)

A83-22153#

WIND TUNNEL INVESTIGATION OF THE TRANSONIC AERODYNAMIC CHARACTERISTICS OF FORWARD SWEEP WINGS

G. C. UHUAD, T. M. WEEKS, and R. LARGE (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) Journal of Aircraft, vol. 20, Mar. 1983, p. 195-202.

(Previously announced in STAR as N81-16011)

A83-22162#

ROTOR HOVERING PERFORMANCE USING THE METHOD OF FAST FREE WAKE ANALYSIS

R. H. MILLER (MIT, Cambridge, MA) Journal of Aircraft, vol. 20, Mar. 1983, p. 257-261. refs

(Previously cited in issue 08, p. 1178, Accession no. A82-22044)

A83-22588

ANALYSIS OF AERO-OPTIC INTERFACE PHENOMENA

R. W. FISHER (McDonnell Aircraft Co., St. Louis, MO) In: Airborne reconnaissance V; Proceedings of the Seminar, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1981, p. 120-127.

A computer program called ATTEND has been developed which is capable of computing the vehicle flow field in three dimensions from freestream to the vehicle surface including the turbulent boundary layer. The ATTEND program models the vehicle surface using small plane elements which provide a good approximation to the vehicle mold line. For a given fuselage line, air density is computed along radial lines that originate at butt line 0 and a selected waterline, usually about half the overall vehicle height. To assess the computational accuracy of the program, an advanced RF-4C nose was analyzed in terms of pressure along the mold line, and the calculated results were compared with wind-tunnel measurements. Agreement was good, with the exception of the aft region where a local shock exists whose position is very sensitive to the surface profile. This analytical technique can be useful in aircraft design for maximum sensor performance. V.L.

A83-22647

A TRANSONIC QUASI-3D ANALYSIS FOR GAS TURBINE ENGINES INCLUDING SPLIT-FLOW CAPABILITY FOR TURBOFANS

W. G. HABASHI (Concordia University, Montreal, Canada) and G. G. YOUNGSON (Pratt and Whitney Aircraft of Canada Ltd., Longueuil, Quebec, Canada) International Journal for Numerical Methods in Fluids, vol. 3, Jan.-Feb. 1983, p. 1-21. Natural Sciences and Engineering Research Council refs

(Contract NSERC-P-7901; NSERC-A-3662)

A numerical approximation is taken to the solution of the complex flows existing in gas turbine engines with transonic blading. The quasi-3D approach decouples the problem into through-flow and blade-to-blade solutions. An industrially practical finite element through-flow solution is developed and for blade-to-blade solutions a transonic finite areas method is utilized. The finite element code developed is capable of operating in an analysis or a design mode. In both modes a dynamic relaxation factor is employed and considerable reduction in solution time can be achieved. Comparisons to streamline curvature methods are carried out for simple analytical and complex industrial problems. (Author)

N83-16284*# Virginia Polytechnic Inst. and State Univ., Blacksburg.

SUBSONIC STEADY AND UNSTEADY AERODYNAMIC LOADS ON MISSILES AND AIRCRAFT Final Progress Report

18 Jan. 1983 8 p

(Contract NSG-1262)

(NASA-CR-169749; NAS 1.26:169749) Avail: NTIS HC A02/MF A01 CSCL 01A

Steady lifting flows over highly swept delta wings at large incidence were studied. After an exhaustive literature review, development of a vortex-lattice method was attempted. To demonstrate the feasibility of using such a method, an existing code was modified. A system of vortex lines to simulate the leading-edge wake was added. The coefficients predicted by the modified code were in good agreement with experimental data.

Author

N83-16286*# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering and Applied Mechanics.

COMPRESSOR CASCADE PERFORMANCE DETERIORATION CAUSED BY SAND INGESTION

W. TABAKOFF and C. BALAN Nov. 1982 71 p refs

(Contract NSG-3218)

(NASA-CR-168067; NAS 1.26:168067) Avail: NTIS HC A04/MF A01 CSCL 01A

Airfoil cascade erosion and performance deterioration was investigated in a gas particle cascade tunnel. The cascade blades were made of 2024 aluminum alloy and the solid particles used were quartz sand. The results of the experimental measurements are presented to show the change in the blade surface erosion, pressure distribution and the total loss coefficient with erosion. The surface quality of the blades exposed to particulate flows are changing the material surfaces. With time, the surface roughness increases and leads to a decrease in engine performance. It was found that the surface roughness values increase asymptotically to a maximum value with increased erosion. The experimental results indicate that the roughness parameters correlate well against the mass of particles impacting unit area of the surface. Such a correlation is useful in aerodynamics and performance computations in turbomachinery.

Author

N83-16287*# Wichita State Univ., Kans.

WIND TUNNEL FORCE AND PRESSURE TESTS

W. H. WENTZ, JR. Jun. 1981 114 p refs

(Contract NSG-1165)

(NASA-CR-3439; NAS 1.26:3439; WSU-AR-78-4) Avail: NTIS HC A06/MF A01 CSCL 01A

Force and surface pressure distributions were measured for a 13% medium speed (NASA MS(1)-0313) airfoil fitted with 20% aileron, 25% slotted flap and 10% slot lip spoiler. All tests were conducted in the Walter Beech Memorial Wind Tunnel at a

Reynolds number of 2.2 million and a Mach number of 0.13. Results include lift, drag, pitching moments, control surface normal force and hinge moments, and surface pressure distributions. The basic airfoil exhibits low speed characteristics similar to the GA(W)-2 airfoil. Incremental aileron and spoiler performance are quite comparable to that obtained on the GA(W)-2 airfoil. Slotted flap performance on this section is reduced compared to the GA(W)-2, resulting in a highest c_{sub} max of 3.00 compared to 3.35 for the GA(W)-2. M.G.

N83-16288*# North Carolina State Univ., Raleigh.
A STUDY OF OPTIMUM COWL SHAPES AND FLOW PORT LOCATIONS FOR MINIMUM DRAG WITH EFFECTIVE ENGINE COOLING, VOLUME 1

S. R. FOX and F. O. SMETANA Nov. 1980 119 p refs
 (Contract NSG-1584)
 (NASA-CR-159379; NAS 1.26:159379) Avail: NTIS HC A06/MF A01 CSCL 01A

The contributions to the cruise drag of light aircraft arising from the shape of the engine cowl and the forward fuselage area and also that resulting from the cooling air mass flow through intake and exhaust sites on the nacelle were analyzed. The methods employed for the calculation of the potential flow about an arbitrary three dimensional body are described with modifications to include the effects of boundary layer displacement thickness, a nonuniform onset flow field (such as that due to a rotating propeller), and the presence of air intakes and exhausts. A simple, reliable, largely automated scheme to better define or change the shape of a body is also presented. A technique was developed which can yield physically acceptable skin friction and pressure drag coefficients for isolated light aircraft bodies. For test cases on a blunt nose Cessna 182 fuselage, the technique predicted drag reductions as much as 28.5% by body recontouring and proper placements and sizing of the cooling air intakes and exhausts. M.G.

N83-16289*# North Carolina State Univ., Raleigh
A STUDY OF OPTIMUM COWL SHAPES AND FLOW PORT LOCATIONS FOR MINIMUM DRAG WITH EFFECTIVE ENGINE COOLING, VOLUME 2

S. R. FOX and F. O. SMETANA Nov. 1980 203 p refs
 (Contract NSG-1584)
 (NASA-CR-159380; NAS 1.26:159380) Avail: NTIS HC A10/MF A01 CSCL 01A

The listings, user's instructions, sample inputs, and sample outputs of two computer programs which are especially useful in obtaining an approximate solution of the viscous flow over an arbitrary nonlifting three dimensional body are provided. The first program performs a potential flow solution by a well known panel method and readjusts this initial solution to account for the effects of the boundary layer displacement thickness, a nonuniform but unidirectional onset flow field, and the presence of air intakes and exhausts. The second program is effectually a geometry package which allows the user to change or refine the shape of a body to satisfy particular needs without a significant amount of human intervention. An effort to reduce the cruise drag of light aircraft through an analytical study of the contributions to the drag arising from the engine cowl shape and the forward fuselage area and also that resulting from the cooling air mass flowing through intake and exhaust sites on the nacelle is presented. The programs may be effectively used to determine the appropriate body modifications or flow port locations to reduce the cruise drag as well as to provide sufficient air flow for cooling the engine. Author

N83-16290*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

LOW-SPEED AERODYNAMIC CHARACTERISTICS OF A 17-PERCENT-THICK MEDIUM SPEED AIRFOIL DESIGNED FOR GENERAL AVIATION APPLICATIONS

R. J. MCGHEE and W. D. BEASELEY Dec. 1980 87 p refs
 (NASA-TP-1786; L-13900; NAS 1.60:1786) Avail: NTIS HC A05/MF A01 CSCL 01A

Wind tunnel tests were conducted to determine the low speed two dimensional aerodynamic characteristics of a 17 percent thick medium speed airfoil (MS(1)-0317) designed for general aviation applications. The results were compared with data for the 17 percent thick low speed airfoil (LS(1)-0417) and the 13 percent thick medium speed airfoil (MS(1)-0313). Theoretical predictions of the drag rise characteristics of this airfoil are also provided. The tests were conducted in the Langley low turbulence pressure tunnel over a Mach number range from 0.10 to 0.32, a chord Reynolds number range from 2 million to 12 million, and an angle of attack range from about -8 to 20 deg. M.G.

N83-16291*# National Aeronautics and Space Administration, Washington, D. C.

THE CALCULATION OF SEPARATED FLOW AT HELICOPTER BODIES

G. POLZ May 1982 28 p refs Transl. into ENGLISH of "Zur Berechnung der Abgelosten Stromung an Hubschrauberrumpfen" DGLR-Paper-81-026 DGLR, Aachen, 11-14 May 1981 p 1-26 Previously announced as A81-47555 Transl. by Kanner (Leo) Associates, Redwood City, Calif. Original doc. prep. by Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Contract NASW-3541)
 (NASA-TM-76715; NAS 1.15:76715) Avail: NTIS HC A03/MF A01 CSCL 01A

For abstract see A81-47555.

N83-16292 Royal Aircraft Establishment, Farnborough (England).

FINITE DIFFERENCE CALCULATION OF AN INVISCID TRANSONIC FLOW OVER OSCILLATING AIRFOILS

T. ISHIGURO Jun. 1982 44 p refs Transl. into ENGLISH of Rept. TR-632 Japan National Aerospace Lab., Tokyo, Oct. 1980 (RAE-TRANS-2087; BR86199) Avail: Issuing Activity

A procedure is presented to calculate the compressible inviscid unsteady transonic flow over an airfoil, which oscillates sinusoidally in pitch. The exterior of the airfoil-shaped contour in the physical plane is mapped onto a rectangle in a computational plane. The two dimensional unsteady Euler equations are solved there by the Lax-Wendroff finite difference scheme with artificial viscosity. Test calculations were made for the unsteady flows over the Joukowski airfoil and the NACA 0012 airfoil oscillating in pitch, in order to obtain several individual flow patterns. Author

N83-16293# Lancaster Analytics, North Canton, Ohio.

NAVAL AIRSHIP PROGRAM FOR SIZING AND PERFORMANCE (NAPSAP), COMPUTER PROGRAM DEVELOPMENT: PROGRAM UPDATE NUMBER 2 Final Report

J. W. LANCASTER 1 Oct. 1982 77 p refs
 (Contract N62269-81-M-3248; N62269-80-M-2376)
 (AD-A120830; LA-TR-4; NADC-81218-60) Avail: NTIS HC A05/MF A01 CSCL 01C

A computer program called NAPSAP, for Naval Airship Program for Sizing and Performance, performs preliminary vehicle design and performance evaluations for both rigid and non-rigid Lighter Than Air (LTA) vehicles. Program capabilities have been tailored to vehicle sizes and missions currently being investigated as part of the joint U.S. Navy - U.S. Coast Guard Maritime Patrol Airship, MPAS, Program and U.S. Navy Operational Mission Applications. The program has been designed to operate on a minimum of input data (only five cards are necessary) but has the capability to examine the influence of some 40 key parameters. Once the design section of NAPSAP converges on a vehicle which meets the input requirements (such as maximum speed, payload, endurance, etc.) this vehicle can then be operated against a

02 AERODYNAMICS

specified mission profile. Program developments include the addition of more detailed static aerodynamic coefficients, configuration/geometry details, static weight and balance calculations and the capability to analyze mission performance in towing operations in considerable detail. In its present form core memory size is 150K octal words on CD 6600 or 600 K bytes on IBM equipment. Normal run time is less than 4.0 CPU seconds.

GRA

N83-16300# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

LASER-DOPPLER VELOCIMETER (LDV) MEASUREMENTS OF THE VELOCITY FIELD OF A LEADING EDGE VORTEX OVER A DELTA WING BEFORE AND AFTER VORTEX BREAKDOWN

K. ANDERS Mar. 1982 34 p refs

(VKI-TN-142) Avail: NTIS HC A03/MF A01

The results of velocity measurements in the flow field over a delta wing with aspect ratio 1.6 at angles of attack 19.3 deg and 28.9 deg are given. The experiments were performed with laser Doppler velocimetry in backscatter mode. Only 50% of maximum laser power was used. Measurements were made in a nonburst as well as in a burst vortex. The experiments were carried out in the L-2B low speed tunnel at free stream velocities of 18 m/s to 19.5 m/sec. The results are compared with theoretical calculations of the velocity distribution by Hall and Ludwig and Ludwig's stability theory of vortex breakdown. The assumption of a conical flow within the vortex was proved to be valid except near the trailing edge. The axisymmetry of the flow field could not be proved. Deviation of the measured velocity distribution from an ideal Hall vortex is probably due to vortex asymmetry.

Author (ESA)

N83-16301# Von Karman Inst. for Fluid Dynamics, Rhode-Saint-Genese (Belgium).

THE WAKE OF A SIDESLIPPING WING IN LOW SPEED FLOW

E. MEINEKE Jun. 1982 36 p refs Sponsored by German Ministry of Defence

(VKI-TN-143) Avail: NTIS HC A03/MF A01

Flow fields of moderate aspect ratio wings under the influence of sideslip were studied. Flow velocity and local total pressure were measured at a large number of measuring points in rectangular control regions perpendicular to the free stream. Detailed pictures were obtained of the vortical wake formed by vortex sheets shed from the lifting wing and rolling up from its free edges, and of the viscous wake revealed by regions of high total pressure loss. The investigation, completed by measurements in the vicinity of the tips and flow visualizations, shows that an important contribution to the development of a flow field with sideslip comes from the flow around the tips. Comparison with results of the British Aerospace Hunt-Semple panel program (which, on the basis of an inviscid flow model and supplemented by a wake relaxation algorithm, provides flow field data) suggests that at least qualitatively, the simulation of the experimental results by computation is possible.

Author (ESA)

N83-16303# Bristol Univ. (England). Dept. of Aeronautical Engineering.

A LABORATORY METHOD FOR THE ANALYSIS OF HELICOPTER UNDERSLUNG LOAD OSCILLATIONS B.S. Thesis

V. POON and J. SOON Jun. 1982 115 p refs

(BU-273) Avail: NTIS HC A06/MF A01

A reliable method based on strain gage measurements was developed for recording the motions, frequencies and other relevant information, e.g., drag forces of the underslung loads when oscillating in a wind tunnel. The effects of fixed and moving supports on the underslung load motions, and hence on its stability characteristics, were studied at Reynolds number and Froude number of 68,000 and 6.5 respectively. A definite difference in the types of motions of the load is observed. This suggests that a moving support is required if accurate results on the underslung load stability characteristic are to be obtained using the wind tunnel.

Author (ESA)

N83-16305# Bristol Univ. (England). Dept. of Aeronautical Engineering.

AN INVESTIGATION AND COMPARISON OF THE AERODYNAMIC PERFORMANCE OF SELECTED HANG-GLIDER AIRFOIL SECTIONS B.S. Thesis

G. P. HANSON and S. W. MCLAREN Jun. 1982 65 p refs

(BU-276) Avail: NTIS HC A04/MF A01

Tests were made on two dimensional full scale wind tunnel models of hang glider airfoil sections with end plates at $Re = 720,000$ based on chord. Aerodynamic force coefficients were determined by analysis of pressure distributions measured using a pressure transducer, through a chordline incidence range of -10 to 30 deg. Seven models of various cambers and thickness-to-chord ratios, constructed in a similar manner to contemporary hang gliders, were tested. Comparisons of the glide angle and sinking speed behavior throughout the incidence range are made with a contemporary hang glider airfoil section. Improvements to minimum glide angle, minimum sinking speed and maximum lift are made, but usually to the detriment of other aspects of the performance.

Author (ESA)

N83-16306# Bristol Univ. (England). Dept. of Aeronautical Engineering.

A STUDY OF THE FLOW AROUND A SLOTTED FLAP END B.S. Thesis

K. J. HARPER and J. R. SLEEMAN Jun. 1982 36 p refs

(BU-279) Avail: NTIS HC A03/MF A01

Chordwise pressure distributions were measured over a two dimensional airfoil section at various spanwise stations relative to the end of a part-span slotted flap, at a Reynolds number of 1.04 times 10 to the 6th power based on the main airfoil chord, for several angles of flap deflection. A single chordwise row of pressure tapings was used on the main airfoil and its position relative to the flap end was adjusted by changing the spanwise extent of the flap into the flow. Pressure distributions were also recorded over the flap at various stations from its end. These results, together with flow visualization, give a general indication of the flow pattern around the flap end and the effect on the spanwise distribution of lift.

Author (ESA)

N83-17471# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Aerodynamics Dept.

THE ROLE OF ANALYSIS IN THE AERODYNAMIC DESIGN OF ADVANCED ROTORS

L. DADONE *In* AGARD Prediction of Aerodyn. Loads on Rotorcraft 12 p Sep. 1982 refs

Avail: NTIS HC A14/MF A01

The extent to which flow analysis influences rotor design is reviewed from a manufacturer's point of view. An interim method is suggested for defining tip geometries for high speed flight until rotor blades can be modeled more rigorously. The potential value of new computational methods in improving the aerodynamic efficiency of helicopter rotors is addressed.

A.R.H.

N83-17472# Westland Aircraft Ltd., Hayes (England).

REPRESENTATION OF AIRFOIL BEHAVIOUR

T. S. BEDDOES *In* AGARD Prediction of Aerodyn. Loads on Rotorcraft 11 p Sep. 1982 refs

Avail: NTIS HC A14/MF A01

A time delay model for dynamic stall, generated several years ago, is discussed with regard to current applications in rotor analysis programs. The shortcomings of the model are highlighted to illustrate the objectives for an improved approach. A formulation is presented for a second generation model for unsteady airfoil behavior. This involves the identification and representation of, trailing edge and leading edge or shock induced separation together with vortex shedding, where appropriate, all within the constraints imposed by computational requirements. The overall model is structured around the solution for time dependant fully attached flow. For a sampled solution which follows from the azimuth stepping procedure of the rotor calculation, the most appropriate form is the indicial response function for which standard solutions are available.

A.R.H.

N83-17473# Office National d'Etudes et de Recherches Aérospatiales, Paris (France).

STUDIES OF AEROFOILS AND BLADE TIPS FOR HELICOPTERS

J. J. THIBERT and J. J. PHILIPPE /in AGARD Prediction of Aerodyn. Loads on Rotorcraft 14 p Sep. 1982 refs In FRENCH; ENGLISH summary
Avail: NTIS HC A14/MF A01

The design methodology of a family of airfoils is presented and the performances of these airfoils deduced from wind tunnel tests are compared with those of other known airfoils and with the theoretical predictions. Theoretical and experimental studies of the flow around several blade tips are presented. Emphasis is put on the design of new blade tips in order to improve the advancing blade behavior and so the total rotor performances.

A.R.H.

N83-17474# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

CALCULATION OF 3D UNSTEADY TRANSONIC FLOW AROUND ROTOR BLADES

H. STAHL /in AGARD Prediction of Aerodyn. Loads on Rotorcraft 13 p Sep. 1982 refs
Avail: NTIS HC A14/MF A01

By applying and adapting classical wing methods to the special requirements of rotor blade tip flow the limitations of the current methods, such as large computational times can be overcome. The unsteady calculation is carried out by a finite difference method for the 2-D case considering both the angle of attack and the Mach number variation. The 3-D calculation is based on a finite element model for fixed wings, which is adapted for the rotor blade application by a linearly varying velocity distribution over the blade radius. Only the outer 25% of the radius is considered. The final lift and moment distributions on the blade are determined by superposition of 3-D steady and 2-D unsteady results. By adapting these semi-empirical results in rotor models, their applicability can be improved especially for the advancing blade, as well as over the whole azimuth angle region.

A.R.H.

N83-17477# Institut de Mécanique des Fluides de Toulouse (France). Inst. de Mécanique.

PREDICTION AND EXPERIMENTAL VERIFICATION OF THE VELOCITY FIELDS OF A ROTOR DURING HOVERING [PREDICTION ET VERIFICATION EXPERIMENTALE DU CHAMP DES VITESSES D'UN ROTOR EN VOL STATIONNAIRE]

C. MARESCA, M. N. MBA, and D. FAVIER /in AGARD Prediction of Aerodyn. Loads on Rotorcraft 18 p Sep. 1982 refs In FRENCH

Avail: NTIS HC A14/MF A01

The hypotheses and confidence limits of a computer program relating to the performance of a helicopter rotor during hovering are tested. This computation, which is based on the principle of putting into partial equilibrium an initially prescribed wake using empirical laws, permits the instantaneous determination of the velocity fields and associated performances. Three components of the velocity vector were measured with the aid of crossed hot-wire and laser anemometers. The swirling lines of the tip were determined by visualization and crossed hot-wire anemometer. Total forces (traction and coupled) were likewise measured. The comparison of computation with experiment involved large scale variations of parameters: number of blades, general passage, twisting action (linear and nonlinear), and tip geometry. Results show satisfactory calculation for certain configurations. For other configurations, results remain to be seen. The consideration of a better modeled far wake and of a evolving structure of a turbulent hub prove indispensable in the computation model.

Transl. by A.R.H.

N83-17478# Bell Helicopter Co., Fort Worth, Tex. Aerodynamics Technology Dept.

VELOCITY COUPLING. A NEW CONCEPT FOR HOVER AND AXIAL FLOW WAKE ANALYSIS AND DESIGN

J. D. KOCUREK and L. F. BERKOWITZ /in AGARD Prediction of Aerodyn. Loads on Rotorcraft 13 p Sep. 1982 refs
Avail: NTIS HC A14/MF A01

The history and development of the distorted prescribed wake method is reviewed as introduction to velocity coupling, a approach which defines the key parameters of the wake in hover and axial translation. This technique is formulated from the concept of principal wake induced velocities which are calculated iteratively as simple functions of loading and key geometric characteristics of the near wake tip vortex spirals. This velocity coupled wake model predicts the hovering rotor's wake geometry in greater detail as compared to earlier methods. Also, correlation with a rotor in axial climb demonstrates the successful application of the method to this regime. These examples illustrate how the velocity formulation isolates the major interactions of the wake elements, by not only clarifying experimentally observed characteristics, but also providing a physical basis for systematic refinement of the prescribed wake method.

A.R.H.

N83-17479# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).

STUDIES ON BLADE-TO-BLADE AND ROTOR-FUSELAGE-TAIL INTERFERENCES

H. HUBER and G. POLZ /in AGARD Prediction of Aerodyn. Loads on Rotorcraft 16 p Sep. 1982 refs
Avail: NTIS HC A14/MF A01

Analytical modeling techniques, including prescribed-contracted-wake analysis, and free-wake-models are described for the blade-blade vortex interaction phenomenon, where the unsteady pressure fluctuations, due to the vortices impact, result in highly impulsive blade loadings, excessive dynamic hub forces/moments, and impulsive noise signatures. Experimental results obtained from in-flight blade modal bending measurements are presented. The interactional aerodynamic flow from the fuselage to the rotor blades is treated. A singularity model is used for the flow calculation around the fuselage body. Parametric influences of the rotor-fuselage separation distance are shown. Interference flow effects between the rotor head and fuselage to the tail area are investigated. For the analytical representation of the steady interference flow a model, containing separated flow calculation, is used. Steady pressure contours and dynamic pressure and flow angle fluctuations at the empennage/tail rotor area are shown including WT-model and full-scale flight test results.

A.R.H.

N83-17480# Pisa Univ. (Italy). Istituto di Macchine.

ROTOR-FUSELAGE INTERFERENCE ON ENGINE INTERNAL AERODYNAMICS IN MANEUVERING HIGH-SPEED ROTORCRAFT

D. DINI /in AGARD Prediction of Aerodyn. Loads on Rotorcraft 14 p Sep. 1982 refs
Avail: NTIS HC A14/MF A01

Because of the rotor-fuselage integration, aeroelastic instabilities must be predicted for a reliable engine control design. Fatigue limits imposed on helicopter engines are more severe than in other automotive application, because of the vibration level induced in the engine core. Periodic aerodynamic and inertial blade loadings may have serious consequences with respect to the shafts and the discs to which these blades are attached. Flutter, with either random or uniform phasing between adjacent blades, may exert oscillatory root reactions that integrate for the entire disc and excite a shaft resonance. Unsteady loads resulting from rotor blades vortex interactions and aerodynamic interference effects with the fuselage in high flight speed rotorcraft are considered from the point of view of the influence on engine internal aerodynamics

Author

N83-17481# Royal Aircraft Establishment, Farnborough (England). Structures Dept.

DEVELOPMENT OF THE VORTEX RING WAKE MODEL AND ITS INFLUENCE ON THE PREDICTION OF ROTOR LOADS

C. YOUNG /In AGARD Prediction of Aerodyn. Loads on Rotorcraft 13 p Sep. 1982 refs

Avail: NTIS HC A14/MF A01

The wake trailed by helicopter rotor blades which is important in the determination of loads and vibrational forces transmitted to the fuselage was examined. The vortex ring wake model is widely used in the prediction of helicopter rotor loads. The evolution of the model is traced from the original form developed over 10 years ago to the current version which includes the distortion due to the aircraft fuselage and an interactive near wake. The effects of improvements in the model are illustrated at each stage with comparisons between flight test data obtained with the Puma helicopter. The predicted and measured hub forces and moments for the Lynx helicopter are compared. E.A.K.

N83-17484# Sikorsky Aircraft, Stratford, Conn. Aeromechanics Dept.

REVIEW OF ROTOR LOADS PREDICTION METHODS

P. J. ARCIDIACONO and R. SOPHER /In AGARD Prediction of Aerodyn. Loads on Rotorcraft 18 p Sep. 1982 refs

Avail: NTIS HC A14/MF A01

Recent progress made in predicting rotor loads is reviewed. The development of improved loads analysis is reviewed. Technical areas recommended for priority attention in the future and the perception of technology opportunities are identified. The aerodynamic aspects of rotor loads analyses generally have not changed greatly since 1974. Progress was made in addressing the fundamental aerodynamic areas, this progress is not always integrated into the load programs. The structural aspects of the loads programs have advanced, particularly with respect to consistent formulation of equations and the ability to efficiently assemble the desired dynamic elements for problems of varying degrees of complexity. E.A.K.

N83-17486# Societe Nationale Industrielle Aerospatiale, Marseille (France).

METHODS USED AT AEROSPATIALE FOR CALCULATING THE LOADS ON A ROTOR AND EXPERIMENTAL CROSS CHECKS [METHODES DE CALCUL DES CHARGES SUR ROTOR UTILISEES A L'AEROSPATIALE ET RECOUPEMENTS EXPERIMENTAUX]

B. MASURE and VUILLET /In AGARD Prediction of Aerodyn. Loads on Rotorcraft 13 p Sep. 1982 refs In FRENCH

Avail: NTIS HC A14/MF A01

The modal method, the method of azimuths, and a simplified method for calculating static loads are presented. The simplifying hypotheses held, common to all three methods, are reviewed as well as the condensed form of the basic equations established. The principal characteristics of the methods are described. The quality of these prediction methods is then analyzed using cross checks with flight tests on the prototype Gazelle 3492 and on the Super Puma AS332. For the former, the comparison concerns only dynamic forces; for the latter, dynamic and static forces. The only flights considered are stabilized flights with or without the load factor. Agreement is generally satisfactory but certain anomalies sometimes appear for static loads at the base of the blade as well as for torsion moments. For the latter case, the poor quality of the cross checks should be attributable to the fact that unsteady aerodynamic phenomena, not modeled in the present numerical application, play a role that cannot be neglected.

Transl. by A.R.H.

N83-17487# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.

COMPARISON OF ROTOR ANALYSIS RESULTS WITH AERODYNAMIC WINDTUNNEL DATA

H. J. LANGER, W. V. GRUENHAGEN, and B. JUNKER /In AGARD Prediction of Aerodyn. Loads on Rotorcraft 13 p Sep. 1982 refs

Avail: NTIS HC A14/MF A01

Measurements for hub moments and blade stresses are presented. Downwash velocities are recorded under the retreating and advancing side of the rotor. The windtunnel measuring data are compared with calculations and computer programs were built up to calculate downwash as well as rotor and blade forces and moments. Different procedures are compared with windtunnel measurements. The results of the calculation of the hub loads, blade loads, and downwash vary considerably, so that the accuracy of the different calculation methods can be checked. E.A.K.

N83-17488# Royal Aircraft Establishment, Bedford (England). Flight Systems Dept.

AN APPRAISAL OF ROTOR BLADE-TIP VORTEX INTERACTION AND WAKE GEOMETRY FROM FLIGHT MEASUREMENTS

P. BROTHERHOOD /In AGARD Prediction of Aerodyn. Loads on Rotorcraft 14 p Sep. 1982 refs

Avail: NTIS HC A14/MF A01

The close radial spacing of leading edge pressure transducers used as incidence and loading indicators on a Puma helicopter blade produces a global picture of the effects of blade tip vortex interaction. Features of the wake geometry are compared with prediction and the loading action of the tip vortex on the following blade is assessed. E.A.K.

N83-17508*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

EFFECT OF EXTERNAL STORES ON THE STABILITY AND CONTROL CHARACTERISTICS OF A DELTA WING FIGHTER MODEL AT MACH NUMBERS FROM 0.60 TO 2.01

M. L. SPEARMAN Jan. 1983 38 p refs

(NASA-TM-84596; NAS 1.15:84596) Avail: NTIS HC A03/MF A01 CSCL 01A

An investigation has been made to determine the effects of external stores on the stability and control characteristics of a delta wing fighter airplane model at Mach numbers from 0.60 to 2.01 for a Reynolds number of 3.0×10^6 per foot. The angle-of-attack range was from about -4 degrees to 20 degrees at a sideslip angle of 0 degrees for the transonic tests, and from about -4 degrees to 10 degrees at sideslip angles of 0 degrees and 3 degrees for the supersonic tests. In general, the results of the tests indicated no seriously detrimental effects of the stores on the stability and control characteristics of the model but did show an increase in the minimum drag level throughout the Mach number range. However, the drag-due-to-lift was such that for subsonic/transonic speeds, the drag at higher lifts was essentially unaffected and the indications are that the maneuvering capability may not be impaired by the stores. Author

N83-17509*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TURBOFAN BLADE STRESSES INDUCED BY THE FLOW DISTORTION OF A VTOL INLET AT HIGH ANGLES OF ATTACK

R. C. WILLIAMS, J. H. DIEDRICH, and R. J. SHAW Jan. 1983 25 p refs

(NASA-TM-82963; E-1380; NAS 1.15:82963) Avail: NTIS HC A02/MF A01 CSCL 01A

A 51-cm-diameter turbofan with a tilt-nacelle VTOL inlet was tested in the Lewis Research Center's 9- by 15-Ft Low Speed Wind Tunnel at velocities up to 72 m/s and angles of attack up to 120 deg. Fan-blade vibratory stress levels were investigated over a full aircraft operating range. These stresses were due to inlet air flow distortion resulting from (1) internal flow separation in the inlet, and (2) ingestion of the exterior nacelle wake. Stress

levels are presented, along with an estimated safe operating envelope, based on infinite blade fatigue life. Author

N83-17510* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
THE MINIMIZATION OF PYLON-MOUNTED STORE EFFECTS ON AIR COMBAT CAPABILITY

M. L. SPEARMAN Jan. 1983 16 p refs
 (NASA-TM-84597; NAS 1.15:84597) Avail: NTIS HC A02/MF A01 CSDL 01A

Some effects of pylon-mounted missiles on aft-tail delta wing supersonic fighter concepts have been investigated. Whereas minimum drag penalties do occur with the addition of missiles, the effects at higher lifts, corresponding to maneuvering flight, are less severe and often favorable. Lower speeds and altitudes enhance the maneuvering capability and one-on-one air combat would probably tend to degenerate to subsonic speeds even though the combatants may be flying supersonic fighters. Higher speed (supersonic) flight might best be reserved for interceptors with long-range missiles where the weapon carriage effects at low angles of attack are of prime importance. Author

N83-17515* General Dynamics Corp., Fort Worth, Tex.
DEVELOPMENT OF AERODYNAMIC PREDICTION METHODS FOR IRREGULAR PLANFORM WINGS Final Report

D. B. BENEPE, SR. Washington NASA Feb. 1983 477 p refs
 (Contract NAS1-15073)
 (NASA-CR-3664; NAS 1.26:3664) Avail: NTIS HC A21/MF A01 CSDL 01A

A set of empirical methods was developed to predict low-speed lift, drag and pitching-moment variations with angle of attack for a class of low aspect ratio irregular planform wings suitable for application to advanced aerospace vehicles. The data base, an extensive series of wind-tunnel tests accomplished by the Langley Research Center of the National Aeronautics and Space Administration, is summarized. The approaches used to analyze the wind tunnel data, the evaluation of previously existing methods, data correlation efforts, and the development of the selected methods are presented and discussed. A summary of the methods is also presented to document the equations, computational charts and design guides which have been programmed for digital computer solution. Comparisons of predictions and test data are presented which show that the new methods provide a significant improvement in capability for evaluating the landing characteristics of advanced aerospace vehicles during the preliminary design phase of the configuration development cycle. Author

N83-17517* Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Goettingen (West Germany). Forschungsbereich Stroemungsmechanik.
COMPUTATION OF THE FLOW AROUND WINGS WITH REAR SEPARATION

K. JACOB Jul. 1982 48 p refs
 (DFVLR-FB-82-22) Avail: NTIS HC A03/MF A01, DFVLR, Cologne DM 16

A prediction method for the subsonic flow around wings of transport aircrafts at high angles of attack is presented. The method combines an inviscid 3d lifting surface theory with a 2d airfoil theory, which includes boundary layer calculations and a displacement model for rear separation. The total iterative procedure allows for prediction of the complete wing characteristics including maximum lift and post stall, but is restricted to wings with moderate to high aspect ratio and low sweep. Some results for such wings are shown and partly compared with experiments, including pressure distributions, separation lines, and total lift and drag characteristics. Author

N83-17518* Aeronautical Research Inst. of Sweden, Stockholm. Structures Dept.

SIMPLIFIED FREE WAKE ANALYSIS FOR ROTORS

R. H. MILLER (MIT, Cambridge, Mass.) Aug. 1982 88 p refs
 (Contract NE-5061-014; NE PROJ. HU-2262:1)
 (FFA-TN-1982-07; ASRL-TR-194-3) Avail: NTIS HC A05/MF A01

This report is concerned with the development of a technique for the aerodynamic analysis of rotary wing devices such as wind turbines and helicopters which would be free of the limiting assumptions of existing methods of analysis. For example, although the classical Rankine/Froude momentum theory has proven to be a reliable design tool, at least for preliminary performance estimates, the rotor is modeled as an actuator disc which implies an infinite number of blades. It therefore cannot be used to predict blade loading distributions, nor the effect of the number of blades on performance, or the noise signature in the presence of nonuniform flows due, for example, to tower shadow. These effects are all strongly influenced by aerodynamic interaction between blades, specifically between a blade and the vortices generated by the preceding blade. It is therefore necessary to have recourse to the more powerful, but more complex, vortex theories of classical fluid mechanics. Author

N83-17520* Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Drehfluegler.

TRANSONIC EFFECTS ON HELICOPTER ROTOR BLADES

H. HUBER, V. MIKULLA, and H. STAHL 1982 13 p refs
 Presented at DGLR Symp. on Aeroelasticity, Nuernberg, West Germany, 5-7 Oct. 1981
 (MBB-349-81-O-E) Avail: Issuing Activity

The transonic environment of the helicopter rotor is summarized and the consequences for helicopter high speed behavior are discussed. Numerical methods capable of partially calculating the supercritical flow over the rotor blades are reviewed. Results of computational and experimental (model testing) investigations show that unsteadiness is a major feature of transonic rotor flow. Developments in the field of rotor airfoils and blade tip shapes, optimized under various aspects of transonic and separated flow environment, are discussed. Author (ESA)

N83-17521* Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Drehfluegler.

STUDIES ON BLADE-TO-BLADE AND ROTOR-FUSELAGE-TAIL INTERFERENCES

H. HUBER and G. POLZ 7 May 1982 19 p refs
 Presented at AGARD Fluid Dyn. Panel Specialists' Meeting on Prediction of Aerodyn. Loads on Rotorcraft, London, 17-18 May 1982
 (MBB-351-82-O-E) Avail: Issuing Activity

Analytical modeling techniques for helicopter blade-to-blade vortex interaction including prescribed-contracted-wake analysis, and free-wake models are described and results of analytical investigations are discussed. Experimental results obtained from in-flight blade model bending measurements are presented. Interactional aerodynamic flow from the fuselage to the rotor blades is treated. Analytical investigations, using a singularity model for the flow calculation around the fuselage body, are described. Parametric influences of the rotor-fuselage separation distance are shown. Interference flow effects between the rotor head and fuselage to the tail area were investigated. For the analytical representation of the steady interference flow, a model containing separated flow calculation is used. Experimental results, including steady pressure contours and dynamic pressure and flow angle fluctuations at the empennage/tail rotor area, are shown.

Author (ESA)

N83-17522# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Drehfluegler.

FORCE INITIATIONS IN HELICOPTER ROTOR BLADES, WIND CHANNEL FANS AND WIND TURBINES [KRAFTINITIATIONEN IN BLAETTER FUER ROTOREN VON HUBSCHRAUBERN, WINDKANALGEBLAESEN UND WINDTURBINEN]

HAHN 26 May 1982 28 p refs In GERMAN Presented at DGLR Symp. on Entwicklung und Anwendung von CFK-Strukt., Stuttgart, 26-27 May 1982

(MBB-UD-356-82-O) Avail: Issuing Activity

The force initiations in fiber reinforced composite rotor blades for front and rear helicopter rotors, wind tunnel fan rotors, and wind energy turbines were investigated. The force initiations are determined by the blade technology as well as by the rotor hub design. Blade connection domains were proposed, which in their construction and design propose different solutions, corresponding to the different applications. Glass fiber reinforced composites, carbon fiber reinforced composites and mixed constructions with manually impregnated laminates and prepreps were studied. Statistical force initiation calculations were compared with tests on specimen and components. Author (ESA)

03

AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

A83-20768

AIRCRAFT ACCIDENT SURVIVORS AS WITNESSES

R. E. DODGE (Wright State University, Dayton, OH) Aviation, Space, and Environmental Medicine, vol. 54, Feb. 1983, p. 165-167.

This is a study of the reliability of aircraft survivors as witnesses. Some of their statements are compared to known facts at the time of the crash, including the time of the accident and the weather conditions. Other facts are compared between the survivors, such as the mood of the passengers immediately post-crash. The KLM-Pan Am accident in the Canary Islands is used as the study accident. A suggestion for future use of survivors' statements is tendered. (Author)

A83-21876#

REMOTE SENSING OF PROBLEM BIRDS IN AVIATION

B. SAHAI (Indian Space Research Organization, Space Applications Centre, Ahmedabad, India) (Indian Agricultural Research Institute and Aeronautics Research and Development Board, Seminar on Management of Problem Birds in Aviation and Agriculture, New Delhi, India, May 25, 26, 1982.) Aeronautical Society of India, Journal, vol. 34, Feb.-May 1982, p. 3-9. refs

Ways of detecting birds and their breeding grounds around airports and of monitoring the environment around airports are discussed. The factors that attract birds to airports are briefly addressed and the nature of remote sensing systems is reviewed. The application of various types of remote sensing systems, including aerial photography, color infrared photography, television cameras, thermal imaging, and radar, to the detection of birds is discussed. Under the category television cameras, the use of closed circuit TV, low light level TV, and CCD TV are considered. The identification of bird species by remote sensing is also addressed. Land use in the airport environment is briefly treated, and some suggestions toward handling the bird-airport problem in India are made. C.D.

A83-21877#

MANAGEMENT OF BIRD PROBLEM IN INDIAN AIRLINES

R. P. BARNWAL (Indian Airlines, New Delhi, India) (Indian Agricultural Research Institute and Aeronautics Research and Development Board, Seminar on Management of Problem Birds in Aviation and Agriculture, New Delhi, India, May 25, 26, 1982.) Aeronautical Society of India, Journal, vol. 34, Feb.-May 1982, p. 11-13.

The bird problem in Indian aviation is analyzed, and a ten-point action plan to prevent bird strike incidents is suggested. The number of bird strikes to Indian aircraft in recent years and the cost of repairs are shown, and the seasonal factor in such strikes is discussed. The action plan includes recommendations for bureaucratic adjustments, firing sloppy workers, burning grass on both sides of the runway, forming prevention squads to terrify the birds, replacing white lights (especially mercury vapor lights) with sodium vapor lights, surveying the airport area monthly, consulting ornithologists, and cautioning pilots to adjust takeoffs. C.D.

A83-21878#

BIRD STRIKES TO AIRCRAFT AND ASSOCIATED HAZARDS AND PROBLEMS REGARDING THE SAFETY OF AIRCRAFT OPERATIONS

H. B. SINGH (Civil Aviation, New Delhi, India) (Indian Agricultural Research Institute and Aeronautics Research and Development Board, Seminar on Management of Problem Birds in Aviation and Agriculture, New Delhi, India, May 25, 26, 1982.) Aeronautical Society of India, Journal, vol. 34, Feb.-May 1982, p. 15-17.

Modes of discouraging birds from congregating near airports and flying near oncoming aircraft are discussed. Strobe lights and lasers have been installed at the noses of aircraft to warn birds, and the noses have been painted to make the aircraft more conspicuous. Microwaves are effective at short range, but their efficient use is prohibitively expensive. Preventive action to deter bird congregation includes frightening birds and making the airport habitat less attractive to them. Temporarily successful scaring methods include gull corpses nailed to boards, unnatural sounds, and artificial distress calls. The cutting of grass, spraying of insecticides and diesel emulsion, use of sodium vapor lights, incineration of garbage, and shooting of birds are useful modes of habitat manipulation. C.D.

A83-22157#

CTOL, STOAL, V/STOL - AN OPERATIONAL COMPARISON FOR FORWARD DEPLOYED CVNS

W. P. RIVIERE, JR. and N. P. VIGNEVIC (U.S. Naval Air Engineering Center, Lakehurst, NJ) Journal of Aircraft, vol. 20, Mar. 1983, p. 222-228.

(Previously cited in issue 20, p. 3460, Accession no. A81-43131)

A83-22175

RESEARCHERS STUDY METHODS TO COMBAT EFFECTS OF WIND SHEAR

K. F. MORDOFF Aviation Week and Space Technology, vol. 118, Feb. 21, 1983, p. 40-42.

A model of a Boeing 727 simulating takeoff through a severe downburst is described. During the model takeoff and climb, an air column producing a severe downdraft was introduced into the aircraft's climbing flight path. The fan-produced downburst dramatically altered the model's normal climbout by subjecting it to severe tail winds from the downburst's outflow along the ground, forcing the model to crash. In subsequent tests, the radio-controlled elevator was used to lower the model's nose to gain airspeed in an attempt to recover from the downburst. The model repeatedly was forced into the ground with this procedure. When the alternate procedure of using up elevator to increase the angle of attack toward stall speed was used, the model flew very close to the ground but usually was able to fly out of the wind shear. Model thrust was formulated and scaled using a stretched 100 ft elastic towing tether to simulate a gradual and steady acceleration through the climbout. C.D.

A83-22357

OBSCURATION BY HELICOPTER-PRODUCED SNOW CLOUDS
J. F. EBERSOLE (Creative Optics, Inc., Bedford, MA) Optical Engineering, vol. 22, Jan.-Feb. 1983, p. 94-99. Army-sponsored research. refs

Attention is given to a helicopter snow obscuration field test conducted at the SNOW ONE-A test site in Vermont. The test is considered in relation to the temporal and spatial effects of helicopter-downwash-produced snow clouds on visible and infrared transmission. The study shows that it is possible to use blowing snow models along with helicopter down wash models to produce a general model for predicting obscuration by helicopter-produced snow. Consideration is also given to the phenomenon of helicopter contrast enhancement resulting from the obscuration of the dark background by the blowing snow cloud. S.C.S.

A83-22976

STUDIES ON AN ACCELERATION PLATFORM AND AT THE TIME OF A SIMULATED CRASH OF HELICOPTER ANTICRASH SEATS [ETUDES SUR BANC D'ACCELERATION ET LORS D'UN CRASH SIMULE DE SIEGES ANTICRASH D'HELICOPTERES]

B. VETTES and G. BEZAMAT (Centre d'Essais en Vol, Bretigny-sur-Orge, Essonne, France) Medecine Aeronautique et Spatiale, vol. 21, 4th Quarter, 1982, p. 391-397. In French. refs

Test results from the examination of the effectiveness of the energy-absorbing features of helicopter anticrash seats during acceleration and in simulated crashes are reported. Anthropomorphic mannequins were placed in the seats and subjected to horizontal, vertical, and combined accelerations. The seat and mannequin were also dropped from a helicopter airframe which was suspended and made to swing in a pendulous movement. The dummy was equipped with accelerometer in its head, thoracic, and seat regions. Accelerations of 39 g were imparted vertically, resulting in accelerometer readings of 35-36 g, with a loading of 5000 g/sec on the seat accelerometer. A simulated helicopter crash produced an initial negative 25 g force, followed by a sign reversal. The seats were observed to prevent destructive displacements of the body during the tests, although the absolute magnitude of the acceleration could cause injuries. M.S.K.

N83-16308# Federal Aviation Administration, Atlantic City, N.J. Technical Center.

IN-FLIGHT AIRCRAFT SEAT FIRE EXTINGUISHING TESTS (CABIN HAZARD MEASUREMENTS) Final Report, Jun. - Dec. 1981

R. G. HILL, L. C. SPEITEL, C. HUBER, G. JOHNSON, R. FILIPCZAK, T. GUSTAVINO, and C. SARKOS Dec. 1982 46 p refs

(Contract FAA PROJ. 181-350-430)

(FAA-CT-82-111) Avail: NTIS HC A03/MF A01

The results of a test program designed to: (1) determine the amount of toxic decomposition byproducts from the use of Halon 1211 on large seat fires in an aircraft cabin while in flight; (2) compare relative hazard levels from the use of common aircraft hand-held extinguishers (Halon 1211, monammonium phosphate, carbon dioxide, water) on large fire in an aircraft cabin while in flight; and (3) compare the hazards from the hand-held extinguishers extinguishing a large aircraft seat fire to the hazards of an uncontrolled seat fire are described. A series of nine tests was conducted during this project. Two tests each were conducted using Halon 1211, dry powder (monammonium phosphate), water and CO2 extinguishers, and one test in which the seat fire was allowed to burn uncontrolled. Hazard level measurements were taken during all tests, they included heat, smoke, and toxic gas measurements. It was concluded that Halon 1211 can be effectively and safely utilized to extinguish a severe seat fire in a transport passenger cabin. Author

N83-16309# National Transportation Safety Board, Washington, D. C. Bureau of Accident Investigation.

AIRCRAFT ACCIDENT REPORT: SUN WEST AIRLINES FLIGHT 104, PIPER PA-31-350(T-1020), N41070, DURANGO-LAPLATA COUNTY AIRPORT, DURANGO, COLORADO, DECEMBER 31, 1981

4 Nov. 1982 28 p refs

(PB82-910413; NTSB-AAR-82-13) Avail: NTIS HC A03/MF A01

Sun West Airlines Flight 104, a scheduled passenger service commuter air carrier flight departed Albuquerque, New Mexico, at 1855 mountain standard time on December 31, 1981, with five passengers and one pilot aboard for a flight to Durango, Colorado. The en route portion of the flight, conducted under instrument flight rules, was normal. Flight 104 was cleared by Denver Air Route Traffic Control Center at 1951:37 for a VOR approach to Durango-La Plata County Airport. Radar service was terminated at 1953:30, when the flight was about 3 miles northeast of the Aztec Intersection on the VOR approach. About 2000 hours, ground witnesses observed Flight 104 fly over the airport in a northerly direction about over the the VOR transmitter (missed approach point) adjacent to the runway midpoint. The airplane descended and crashed about 1,350 feet east of the departure end of runway 2, about 3,250 feet from the VOR. The airplane was destroyed by impact and postimpact fire. The pilot and three passengers were killed and two passengers were seriously injured in the accident. Weather at the time of the accident was reported as "indefinite ceiling 400 feet sky obscured, 1 mile visibility in light snow and fog, with calm winds." The National Transportation Safety Board was unable to determine the probable cause of this accident, which occurred during an attempted missed approach. A low ceiling and poor visibility were factors which contributed to the accident. Author

N83-16310# Naval Submarine Medical Research Lab., Groton, Conn.

DESIRABLE CHARACTERISTICS OF UNDERWATER LIGHTS FOR HELICOPTER ESCAPE HATCHES Interim Report

S. M. LURIA, B. L. RYACK, and D. F. NERI 22 Sep. 1982 30 p refs

(AD-A120331; NSMRL-990) Avail: NTIS HC A03/MF A01 CSCL 06G

To specify the desirable characteristics of lighting around helicopter escape hatches which must be visible under water, tests were carried out of several types of lights. The optimal arrangement of lights around the hatch, their minimum and maximum intensity, the effects of viewing angle on their visibility, the effects of the dimensions of the lights, and the variations in the intensity of the electro-luminescent panels with changes in the power supplied were determined. Suggestions for lighting specifications are given. Author (GRA)

N83-16311# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biomechanical Protection Branch.

VERTICAL IMPACT TESTS OF A MODIFIED F/FB-111 CREW SEAT TO EVALUATE HEADREST POSITION AND RESTRAINT CONFIGURATION EFFECTS

J. W. BRINKLEY, B. F. HEARON, J. H. RADDIN, JR., L. A. MCGOWAN, and J. M. POWERS Aug. 1982 296 p refs (Contract AF PROJ 7231)

(AD-A120255; AFAMRL-TR-82-51) Avail: NTIS HC A13/MF A01 CSCL 06S

A test program was conducted to evaluate the effects of changes in (1) fore-aft headrest position, (2) upper extremity bracing, and (3) restraint harness configuration on human response to vertical impact. One-hundred and fifteen human tests were performed on the Vertical Deceleration Tower up to an impact level of 10.5 G mean (std dev = 0.14), 26 ft/sec velocity change. Subjects were restrained in either a proposed, modified F/FB-111 crew seat and restraint system or a conventional double shoulder strap - lap belt restraint harness and were exposed to comparable impacts in different upper extremity bracing conditions and at different fore-aft headrest adjustments. Measured data included seat acceleration and velocity, head and chest translational

03 AIR TRANSPORTATION AND SAFETY

acceleration components, tri-axial forces acting on the seat and footrest, forces acting in the restraint harness attachments, and displacements of various body segments. Parametric analysis of the test results was conducted using the Wilcoxon paired-replicate rank test. With the headrest 2 1/4 inches forward of the plane of the seat back, there was increased forward and downward head rotation compared to the headrest 1 inch aft of the seat pack plane. With the headrest 1 inch aft of the plane of the seat pack, there was increased forward-translation of the head compared to the headrest 2 1/4 inches forward of the seat back plane. Subjects utilizing the hands-on-knees bracing position were found to carry a greater proportion of the load through the extremities to the footrest, thereby unloading the vertebral column, than subjects using the hands-in-lap position. GRA

N83-16312# Naval Submarine Medical Research Lab., Groton, Conn.

DESIRABLE CHARACTERISTICS OF UNDERWATER LIGHTS FOR HELICOPTER ESCAPE HATCHES Interim Report

S. M. LURIA, B. L. RYACK, and D. F. NERI 22 Sep. 1982 30 p refs

(Contract N62269-82-WR-00232)

(AD-A120510; NSMRL-990) Avail: NTIS HC A03/MF A01 CSCI 06G

To specify the desirable characteristics of lighting around helicopter escape hatches which must be visible under water, tests were carried out of several types of lights. The optimal arrangement of lights around the hatch, their minimum and maximum intensity, the effects of viewing angle on their visibility, the effects of the dimensions of the lights, and the variations in the intensity of the electro-luminescent panels with changes in the power supplied were determined. Suggestions for lighting specifications are given. Author (GRA)

N83-16313# Sandia Labs., Albuquerque, N. Mex.

SANDIA AIRCRAFT CRASHFIRE FACILITY

W. GILL 1981 36 p Presented at the IMOG Environ. Testing Meeting, Amarillo, Tex., 6 Oct. 1981

(Contract DE-AC04-76DP-00789)

(DE82-004297; SAND-81-2577C; CONF-8110124-2) Avail: NTIS HC A03/MF A01

The design and operation of a facility at Sandia Laboratories for simulating aircraft fuel fires and for determining the effects of such fires on explosives and on aircraft-transportable accident-resistant containers for plutonium pellets are described. DOE

N83-17463# Northwest Airlines, Inc., Minneapolis, Minn.

FUEL CONSERVATION TECHNIQUES IN JET TRANSPORT AIRCRAFT OPERATIONS

H. H. CRAVEN, JR. In DOE Symp. on Com. Aviation Energy Conserv. Strategies p 137-146 Apr. 1981

Avail: NTIS HC A17/MF A01 CSCI 01B

Fuel economy and aerodynamic efficiency in jet transport aircraft operations are discussed. The operational procedures recommended by the aircraft manufacturers were examined, and reasonable alternatives when ATC or flight conditions make those procedures either impractical or impossible are suggested. Basic aerodynamic considerations and their effects on engine and aerodynamic efficiency are emphasized. A density altitude chart with weight limitations for the B-747-1/7A Thrust aircraft, a fuel planning graph for the same airplane, comparative power charts and computer run offs to help substantiate the information are included. E.A.K.

N83-17491# School of Aerospace Medicine, Brooks AFB, Tex.

AN OVERVIEW OF HUMAN FACTORS IN AIRCRAFT ACCIDENTS AND INVESTIGATIVE TECHNIQUES

B. O. HARTMAN In AGARD Human Factors Aspects of Aircraft Accidents 4 p Oct. 1982 refs

Avail: NTIS HC A07/MF A01

Human factors in aircraft accidents and investigative techniques are reviewed. N.W.

N83-17493*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE INFLUENCE OF HANDLING QUALITIES, CRASHWORTHINESS AND OTHER ENGINEERING FACTORS ON AIRCRAFT SAFETY

S. B. ANDERSON In AGARD Human Factors Aspects of Aircraft Accidents 11 p Oct. 1982 refs

Avail: NTIS HC A07/MF A01 CSCI 01C

The relationship of handling qualities to safety, crashworthiness, and survivability are examined. Author

N83-17497*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE ENGINEERING INVESTIGATION OF AIRCRAFT ACCIDENTS

S. B. ANDERSON In AGARD Human Factors Aspects of Aircraft Accidents 8 p Oct. 1982 refs

Avail: NTIS HC A07/MF A01 CSCI 01C

The organization and plan for an investigation, procedures used at the scene of the accident, engineering aspects covered in the main investigation, use of special analytical techniques and simulation tools, and use of flight recorder data are discussed. Examples of investigations are used to illustrate the processes used. Author

N83-17523*# Ohio State Univ., Columbus. Dept. of Aviation.

STATISTICAL SUMMARY: STUDY TO DETERMINE THE IFR OPERATIONAL PROFILE OF THE GENERAL AVIATION SINGLE PILOT Final Report

G. S. WEISLOGEL and G. C. CHAPMAN May 1982 184 p refs

(Contract NAS1-15969)

(NASA-CR-165805; NAS 1.26:165805) Avail: NTIS HC A09/MF A01 CSCI 05J

The statistical summary of data resulting from a mail questionnaire survey designed to develop information on the general aviation single pilot operating under instrument flight rules is presented. Author

N83-17524# Federal Aviation Administration, Atlantic City, N.J.

EQUIVALENCY EVALUATION OF FIREFIGHTING AGENTS AND MINIMUM REQUIREMENTS AT US AIR FORCE AIRFIELDS Final Report, 9 Jan. 1979 - Nov. 1982

G. B. GEYER, J. ONEILL, and C. H. URBAN Oct. 1982 140 p refs

(FAA-CT-82-109) Avail: NTIS HC A07/MF A01

An evaluation of selected aircraft firefighting agents was made both blanketing and auxiliary and of dispersing equipment. Laboratory studies and outdoor fire tests were conducted to ascertain the fire extinguishing equivalency of the auxiliary agents and to determine the most acceptable agents and equipment for use in performing large scale firefighting tests. Author

N83-17526# General Dynamics Corp., Fort Worth, Tex.

ADVANCED ULTRA-VIOLET (UV) AIRCRAFT FIRE DETECTION SYSTEM. VOLUME 1: SYSTEM DESCRIPTION AND FLIGHT TEST Final Report, 15 Dec. 1977 - 26 Oct. 1981

R. J. SPRINGER, P. H. SHEATH, S. P. ROBINSON, and D. J. V. SMITH Wright-Patterson AFB, Ohio AFWAL Aug. 1982 159 p refs

(Contract F33615-77-C-2029; AF PROJ. 2348)

(AD-A121253; AFWAL-TR-82-2062-VOL-1) Avail: NTIS HC A08/MF A01 CSCI 01B

The objective of this program was to utilize ultra-violet (UV) radiation technology to provide advanced means of detecting fire hazards more reliably and more rapidly than current thermally activated continuous cable type systems. The program was divided into four phases. The first phase consisted of analysis and design requirements followed by design and fabrication, environmental testing, and flight testing of the system on an F-111 high performance aircraft. The objectives of this program were met. Two ultra-violet (UV) detection systems were developed, fabricated and test flown. The flight test program demonstrated that the

systems have a fire detection reliability and a freedom from false warnings that are significantly better than existing service equipment. One system, system A, includes a high degree of redundancy such as dual power supplies, dual sensors and dual microprocessors along with self checking and automatic reconfiguration. These features provide a reduction in pilot work load and reduction in unscheduled maintenance actions. The other system, system B, a simplified system, is based on the same design components as system A but only utilizes a single power supply, single sensor and a single microprocessor. Both systems are considered suitable for near-term service applications.

Author (GRA)

04

AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

A83-19777#

FIXED WING AND ROTARY WING FLIGHT TESTING OF NAVSTAR GPS AS A CIVILIAN NAVIGATION SYSTEM

J. T. CONNOR, E. M. SAWTELLE, and R. D. TILL (FAA, Technical Center, Atlantic City, NJ) In: NTC '81; National Telecommunications Conference, New Orleans, LA, November 29-December 3, 1981, Record, Volume 3. New York, Institute of Electrical and Electronics Engineers, Inc., 1981, p. F9.1.1-F9.1.8. refs

Initial test results from FAA trials to determine the suitability of low cost Navstar receivers on board civilian rotary and fixed wing aircraft are reported. Using a Magnavox Z set furnished by the Navstar Program office, interfaces between the set and an airborne data collection computer, between the computer and a course deviation detector, between the set and a tape recorder, and data software were investigated on a CH-53 helicopter. A ground base data collection and an airborne instrumentation system were assembled for a fixed-wing aircraft, a G-159 Gulfstream. Details of the test paths to be followed in both aircraft are outlined. Tests were performed to verify the ground-based software and data analysis routines. Readings within an earth-centered, earth-fixed coordinate system showed errors of less than 15 m in static readings, with some increase while in the navigational mode.

M.S.K.

A83-19779#

A DEMONSTRATION OF RELATIVE POSITIONING USING CONVENTIONAL GPS DOPPLER RECEIVERS

B. R. HERMANN and A. G. EVANS (U.S. Navy, Naval Surface Weapons Center, Silver Spring, MD) In: NTC '81, National Telecommunications Conference, New Orleans, LA, November 29-December 3, 1981, Record, Volume 3. New York, Institute of Electrical and Electronics Engineers, Inc., 1981, p. F9.4.1-F9.4.5.

Two conventional code tracking GPS receiver systems were used to simultaneously track GPS satellites on a short baseline. Doppler counts were obtained at 1-minute intervals from each receiver. Two cases were investigated. In the first, independent frequency standards were used; in the second, a single frequency standard drove both receivers. The solutions for baseline length and direction are discussed.

(Author)

A83-21019#

SUBOPTIMAL FILTERS FOR INS ALIGNMENT ON A MOVING BASE

I. Y. BAR-ITZHACK (Technion - Israel Institute of Technology, Haifa, Israel) In: Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers. Haifa, Technion - Israel Institute of Technology, 1982, p. 163-170. Research supported by the Israel Aircraft Industries, Ltd. and Ministry of Defence of Israel. refs

Very simple reduced order filters which operate in a time sharing mode are proposed for in-flight and transfer alignment of calibrated inertial navigation systems (INS) such as those in fighter aircraft. The coarsely aligned INS is flown for a short duration in a straight and level flight during which two second (or third) order time sharing filters estimate the level misalignment. After removing the estimated level misalignment angles a third (or fourth) order filter is switched in to estimate the azimuth misalignment as the aircraft starts to maneuver in the lateral plane. A true covariance simulation is carried out which shows that the proposed filters successfully perform the fine alignment.

(Author)

A83-21034

A CONCEPT FOR REDUCING HELICOPTER IFR LANDING WEATHER MINIMUMS - ONSHORE

L. LA VASSAR Vertiflite, vol. 29, Jan.-Feb. 1983, p. 28-32.

The primary obstacles to low speed Instrument Flight Rules helicopter flight operation, including the need for sophisticated sensors, a low speed air data system, and a high degree of automation, are associated with the period of aircraft transition from flight to landing through the very low speed band. This complexity and expense could be avoided if it were possible to maneuver through the approach slope at a sustained velocity which avoids the problematic segment of the decelerating envelope. The proposed approach plan involves a modest speed correction which coincides with the 7-deg descent flight path, sustaining 30 knots throughout the final approach corridor while maintaining a stabilized flight condition until reaching the helpoint threshold.

O.C

A83-22523

LASER AND MILLIMETER-WAVE BACKSCATTER OF TRANSMISSION CABLES

H. H. AL-KHATIB (MIT, Lexington, MA) In: Physics and technology of coherent infrared radar; Proceedings of the Meeting, San Diego, CA, August 25, 26, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 212-229. DARPA-sponsored research. refs

The radar cross sections (RCS) of power line cables were calculated and measured at four millimeter-wave frequencies (18, 34, 56, and 94 GHz) and two laser wavelengths (10.6 and 1.06 microns) as a function of aspect angle in order to develop a method for low-flying vehicles to detect and avoid power lines. Horizontal, vertical, and cross polarizations were considered, and dry and wet cable conditions were simulated. It is found that a laser sensor is able to detect transmission lines at all aspect angles, polarizations, and surface conditions. A RCS value of about -35 and -40 dBsm per 1 ft illumination is determined to be required at 1.06 and 10.6 microns, respectively. However, scanning will be required for a millimeter wave sensor in order to detect transmission lines at all aspect angles. By using scanning, the sensor could then detect power lines by identifying the main lobes of cable backscatter along with a comparable backscatter from the power towers. Scanning will not be required if substantial backscatter beyond the angle alpha exists and a large RCS value of about 0 dBsm can be considered at all aspect angles in a real situation.

N.B.

A83-22576

REAL-TIME RECONNAISSANCE - A SYSTEMS LOOK AT ADVANCED TECHNOLOGY

H. LAPP (USAF, Avionics Laboratory, Wright-Patterson AFB, OH) In: Airborne reconnaissance V; Proceedings of the Seminar, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1981, p. 13-19.

Target acquisition through exploitation tasks is discussed together with the applicable advanced technology. A philosophy of processing data to get information as early as possible in the data-handling chain is examined in the context of ground exploitation and dissemination needs. Examples of how the various real-time sensors (screeners and processors), jam-resistant data links, and near-real-time ground data-handling systems fit into the reconnaissance process are discussed. Specific programs of the Department of Defence are examined to illustrate this integrated approach. V.L.

A83-22591

CINNA - A SYSTEM FOR PREPARING RECONNAISSANCE MISSIONS

J. L. PETIT (Matra, S.A., Rueil-Malmaison, Hauts-de-Seine, France) In: Airborne reconnaissance V; Proceedings of the Seminar, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1981, p. 148-154.

An interactive console, CINNA (Digital Interactive Console for Aerial Navigation), has been developed to aid in the preparation of tactical reconnaissance missions. The console provides data on the general situation (enemy defence zones, forbidden zones, etc.), the aircraft performance, and the terrain profile; it supplies the pilot with geographical coordinates or UTM and altitudes of the turning points and targets and a hard copy of a map of the overflow country. The map includes the aircraft route, headings, distances, and time as well as an indication of the safety height to which the aircraft must climb in case the visual ground contact is lost. The system is controlled by a microprocessor-based minicomputer. The nominal time of mission preparation is 15 min. V.L.

A83-22726

PERFORMANCE ANALYSIS OF A DWELL-TIME PROCESSOR FOR MONOPULSE BEACON RADARS

D. GIULI, M. FOSSI (Firenze Università, Florence, Italy), and E. DALLE MESE (Pisa, Università, Pisa, Italy) IEEE Transactions on Aerospace and Electronic Systems, vol. AES-19, Jan. 1983, p. 2-16. Consiglio Nazionale delle Ricerche refs (Contract CNR-80,00385,91)

Performance of a monopulse air traffic control radar beacon system (ATCRBS) target data extractor is analyzed via an analytical approach. Results refer to a statistical analysis of the section of the receiver which associates replies sent by the desired aircraft during the antenna dwell-time. Some numerical results are reported which refer to the ATCRBS section to be devised in the discrete address beacon system (DABS). (Author)

A83-22727

REPLY CORRELATION TEST ANALYSIS IN MONOPULSE BEACON RADARS

M. FOSSI, D. GIULI (Firenze, Università, Florence, Italy), and E. DALLE MESE (Pisa, Università, Pisa, Italy) IEEE Transactions on Aerospace and Electronic Systems, vol. AES-19, Jan. 1983, p. 17-29. Consiglio Nazionale delle Ricerche refs (Contract CNR-80,00385,91)

The statistical behavior of the position data furnished by single air traffic control radar beacon system (ATCRBS) reports is analyzed. Some statistical models are correspondingly derived in order to be employed for the performance evaluation of the dwell-time section of the ATCRBS monopulse receiver. The expression of the failure probability is derived for the range and azimuth tests performed by the association algorithms operating in the monopulse ATCRBS target data extractor. Some numerical

results are reported referring to the evaluation of the above failure probabilities in different conditions. (Author)

A83-22737

F-16 PULSE DOPPLER RADAR /AN/APG-66/ PERFORMANCE
M. B. RINGEL, D. H. MOONEY, and W. H. LONG, III (Westinghouse Electric Corp., Baltimore, MD) IEEE Transactions on Aerospace and Electronic Systems, vol. AES-19, Jan. 1983, p. 147-158. refs

The AN/APG-66 is a digital, multimode, fire control radar that is the primary sensor for the F-16 air combat fighter. The detection and false alarm performance of this radar are described when it operates in its medium PRF pulse Doppler downlook mode. Descriptions are included of medium PRF clutter, the AN/APG-66 signal processing, the flight tests used to obtain performance data, a computer simulation of the radar, and the calibration of the simulation. The detection performance presented is based on both flight tests and the output of the flight test calibrated simulation. The false alarm performance is based on flight tests and is accompanied by a discussion of the sources of false alarms. (Author)

A83-22824

REAL-TIME MULTIRADAR SIMULATION WITH A MULTIPROCESSOR

F. P. HINER, III (Litton Industries, Litton Data Systems, Van Nuys, CA) In: Real-time signal processing IV; Proceedings of the Meeting, San Diego, CA, August 25-28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 280-288. refs

Radar coverage of a region for air defense or air traffic control often necessitates the use of multiple radars in order to compensate for terrain caused coverage problems and/or guarantee a uniformly good probability of detection over the region. Correlation and utilization of data from these sites by totally automatic means is an essentially unsolved problem. Moreover, computer simulation of this problem is ineffective unless a very detailed real time simulation is performed. The multi-radar simulator has been built to provide the means wherein a real time simulation of a system of netted radars, their radar processors, and collocated trackers can be performed. This simulator is an MIMD machine utilizing the building block processor as the processing element. This implementation has proven easy to program and has brought the necessary computational speed to the problem of effectively emulating a set of radars and their processors observing the same air picture from different vantage points. (Author)

N83-16314# SRI International Corp., Menlo Park, Calif.

OCEANIC AREA SYSTEM IMPROVEMENT STUDY (OASIS). VOLUME 1: EXECUTIVE SUMMARY AND IMPROVEMENT ALTERNATIVES DEVELOPMENT AND ANALYSIS Final Report
G. J. COULURIS and B. CONRAD Sep. 1981 402 p refs 10 Vol.

(Contract DOT-FA79WA-4265; SRI PROJ 8066)

(FAA-EM-81-17-VOL-1) Avail: NTIS HC A18/MF A01

The technical, operational, and economic feasibilities of developing and applying potential improvements to air traffic services (ATS) in selected oceanic and low air traffic density areas, while maintaining or enhancing the level of safety are assessed. The improvements of primary concern are those that can enhance separation assurance services and reduce overall operating costs. Flight operating costs may be decreased by reducing constraints imposed by current separation minima. The improvements address communication, navigation, surveillance, and self contained airborne separation assurance functions and associated operating procedures. Quantitative data that can be used by the world aviation community to narrow significantly the choices for improving ATS systems in oceanic areas of the world and in other areas where similar systems can enhance air traffic services is provided. The data is based both on economic assumptions and forecasts, and on analyses or judgments of the feasibility of achieving certain of the technical improvements sought. S.L.

N83-16315# SRI International Corp., Menlo Park, Calif.
**OCEANIC AREA SYSTEM IMPROVEMENT STUDY (OASIS).
 VOLUME 2: NORTH ATLANTIC REGION AIR TRAFFIC
 SERVICES SYSTEM DESCRIPTION Final Report**

G. J. COULURIS Sep. 1981 167 p refs 10 Vol.
 (Contract DOT-FA79WA-4265; SRI PROJ. 8066)
 (FAA-EM-81-17-VOL-2) Avail: NTIS HC A08/MF A01

The ATS system in the North Atlantic oceanic region (NAT) is described, and the services discussed. Radar surveillance of NAT airspace is not conducted due to the lack of ground sites for antennae, and ATS personnel use pilot position reports to monitor oceanic flights. These voice reports are transmitted at least once per hour. Direct air-ground communications between oceanic aircraft and ATS personnel are generally not available. Instead, the ATS units are supported by communication (COM) stations which operate very high frequency and long range, high frequency radio facilities. These COM stations relay messages between pilots and ATS unit personnel. The stations are usually located separately from the ATS units. The ATS units and COM stations, as well as airline, military, meteorological, and other aviation facilities, are connected by the aeronautical fixed telecommunications network which provides teletype service, and ATS direct speech circuits

S.L.

N83-16316# SRI International Corp., Menlo Park, Calif.
**OCEANIC AREA SYSTEM IMPROVEMENT STUDY (OASIS).
 VOLUME 3: CENTRAL EAST PACIFIC REGION AIR TRAFFIC
 SERVICES SYSTEM DESCRIPTION Final Report**

G. J. COULURIS Sep. 1981 66 p refs 10 Vol.
 (Contract DOT-FA79WA-4265; SRI PROJ. 8066)
 (FAA-EM-81-17-VOL-3) Avail: NTIS HC A04/MF A01

The air traffic services (ATS) system in the Central East Pacific (CEP) region is described. This system provides ATC, flight information, and alerting services to aircraft in oceanic control areas flight information regions. The operations, technical components, and costs of the ATS units are addressed.

S.L.

N83-16317# SRI International Corp., Menlo Park, Calif.
**OCEANIC AREA SYSTEM IMPROVEMENT STUDY (OASIS).
 VOLUME 4: CARIBBEAN REGION AIR TRAFFIC SERVICES
 SYSTEM DESCRIPTION Final Report**

G. J. COULURIS Sep. 1981 122 p refs 10 Vol.
 (Contract DOT-FA79WA-4265; SRI PROJ. 8066)
 (FAA-EM-81-17-VOL-4) Avail: NTIS HC A06/MF A01

The air traffic service provided in the Caribbean region (CAR) is addressed. These ATS units use to varying extent the communication, navigation, and surveillance systems that are common to most domestic airspace areas; these systems include very high frequency air-ground voice radio, ground based radio navigation aids and radar surveillance. The radio navigation aids support a system of fixed ATS routes which criss-cross the CAR and are commonly used by flights in the region.

S.L.

N83-16318# SRI International Corp., Menlo Park, Calif.
**OCEANIC AREA SYSTEM IMPROVEMENT STUDY (OASIS).
 VOLUME 5: NORTH ATLANTIC, CENTRAL EAST PACIFIC, AND
 CARIBBEAN REGIONS COMMUNICATION SYSTEMS
 DESCRIPTION Final Report**

B. CONRAD Sep. 1981 109 p refs 10 Vol.
 (Contract DOT-FA79WA-4265; SRI PROJ. 8066)
 (FAA-EM-81-17-VOL-5) Avail: NTIS HC A06/MF A01

Oceanic communications required to support aviation in selected portions of the North Atlantic (NAT), Central East Pacific (CEP), and Caribbean (CAR) areas involve many elements including ground-to-ground communications between air traffic control facilities and available, and air-to-ground communications using very high frequency where available; communications are often conducted by special radio stations which relay messages to air traffic controllers. The NAT is serviced by six major communication stations and the CEP by two. The CAR has a number of domestic service stations and control facilities providing VHF and HF communications to the majority of flights, and at least two major

centers providing HF communications for long range over water operations.

S.L.

N83-16319# SRI International Corp., Menlo Park, Calif.
**OCEANIC AREA SYSTEM IMPROVEMENT STUDY (OASIS).
 VOLUME 7: NORTH ATLANTIC REGION FLIGHT COST MODEL
 RESULTS Final Report**

G. J. COULURIS, J. C. BOBICK, and J. D. TORNOW Sep. 1981 103 p 10 Vol.

(Contract DOT-FA79WA-4265; SRI PROJ. 8066)
 (FAA-EM-81-17-VOL-7) Avail: NTIS HC A06/MF A01

The NAT air traffic flight costs are analyzed, based on results obtained from the computerized flight cost model (FCM). The flight costs associated with present and alternative ATC separation minima are estimated. Data, generated by the FCM, which describe flight operating characteristics, including route and flight level utilization and diversions are presented.

S.L.

N83-16320# SRI International Corp., Menlo Park, Calif.
**OCEANIC AREA SYSTEM IMPROVEMENT STUDY (OASIS).
 VOLUME 8: CENTRAL EAST PACIFIC REGION FLIGHT COST
 MODEL RESULTS Final Report**

D. B. KORETZ and G. J. COULURIS Sep. 1981 90 p 10 Vol.
 (Contract DOT-FA79WA-4265; SRI PROJ. 8066)

(FAA-EM-81-17-VOL-8) Avail: NTIS HC A05/MF A01

The flight cost model (FCM) is a set of computer programs prepared especially for the OASIS project to estimate flight operating costs. The FCM was used to simulate the operations of the Central East Pacific (CEP) air traffic services system and several other system operating alternatives (representing alternative separation minima) on a representative July (peak) day and a representative November (off peak) day. The July sample day operation in each of the three sample years was simulated for eight system alternatives. The November sample day in each year was simulated only for the present system for comparison purposes.

S.L.

N83-16321# SRI International Corp., Menlo Park, Calif.
**OCEANIC AREA SYSTEM IMPROVEMENT STUDY (OASIS).
 VOLUME 9: FLIGHT COST MODEL DESCRIPTION Final
 Report**

K. Y. WANG and D. A. DESOPO Sep. 1981 108 p 10 Vol.
 (Contract DOT-FA79WA-4265; SRI PROJ. 8066)

(FAA-EM-81-17-VOL-9) Avail: NTIS HC A06/MF A01

The functional and logical structure of the flight cost model (FCM) computer program modules which were developed to simulate air traffic operations in oceanic areas is described. The FCM modules include the network generating routine, track setting routine, meteorology routine, flight planning model, flight tracking model and report generating package. The organization of each and the interrelation between these programs are addressed.

S.L.

N83-16322# SRI International Corp., Menlo Park, Calif.
**OCEANIC AREA SYSTEM IMPROVEMENT STUDY (OASIS).
 VOLUME 10: NORTH ATLANTIC, CENTRAL EAST PACIFIC,
 AND CARIBBEAN REGIONS AVIATION TRAFFIC FORECASTS
 Final Report**

C. STARRY and J. D. TORNOW Sep. 1981 375 p 10 Vol.
 (Contract DOT-FA79WA-4265; SRI PROJ. 8066)

(FAA-EM-81-17-VOL-10) Avail: NTIS HC A16/MF A01

Aircraft movements for a busy day and traffic forecasts for July and November busy days for the NAT and CEP are described. The forecasts should be regarded as consensus forecasts that reflect the aviation industry's best judgment concerning the outlook for air traffic and technology.

S.L.

N83-16323# Mitre Corp., McLean, Va.
CONFLICT MONITORING ANALYSIS OF PARALLEL OPPOSITE DIRECTION ROUTES, VOLUME 2
 A. P. SMITH, III Aug. 1982 67 p refs 2 Vol.
 (Contract DTFA01-82-C-10003)
 (AD-A120187; MTR-82W00114-VOL-2; FAA-EM-82-23-VOL-2)
 Avail: NTIS HC A04/MF A01 CSCL 17G

This paper reports on the development of the Conflict Monitoring Analysis. A previous report (FAA-EM-80-16) described the estimates of the probability of horizontal overlap and controller intervention rate for some direction adjacent parallel routes. This work extends that methodology to opposite direction adjacent parallel routes. For both the probability of horizontal overlap and the controller intervention rate, trial results based on data are given. Author (GRA)

N83-16325# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIO NAVIGATION AND AIRPLANE NAVIGATION
 Y. C. WANG 17 Aug. 1982 16 p Transl. into ENGLISH from Hangkong Zhishi (China), Apr. 1982 p 2-4
 (AD-A120595; FTD-ID(RS)T-0870-82) Avail: NTIS HC A02/MF A01 CSCL 17G

The development of radio navigation technology in modern aviation is discussed. The principles and uses of various types of radio navigation in use today are outlined. GRA

N83-17459# Systems Control, Inc., West Palm Beach, Fla. Technology Industries Div.
THE ANALYSIS OF INTEGRATED FUEL EFFICIENT, LOW NOISE PROCEDURES IN LAX TERMINAL AREA OPERATIONS
 J. B. MCKINLEY and R. L. BOWLES (FAA) In DOE Symp. on Com. Aviation Energy Conserv. Strategies p 57-78 Apr. 1981 refs Originally announced as N82-13014
 Avail: NTIS HC A17/MF A01 CSCL 01B

Terminal area fuel conservation and airport noise level relationships are investigated. The potential fuel savings and noise level reduction in the Los Angeles International (LAX) terminal area were quantified. Relaxation of current noise abatement procedure without impacting 1980 noise levels, and at the same time conserving additional fuel was determined. Author

N83-17464# Eastern Air Lines, Inc., Atlanta, Ga. Air Traffic Systems Dept.
AIR TRAFFIC CONTROL: ITS EFFECT ON FUEL CONSERVATION
 E. H. PRICE In DOE Symp. on Com. Aviation Energy Conserv. Strategies p 147-162 Apr. 1981
 Avail: NTIS HC A17/MF A01 CSCL 01B

Air traffic delays and its cost in waste fuel were examined. It is suggested that the most productive way to reduce this huge waste of fuel is to develop a more efficient ATC system, one that minimizes delays and still provides for reasonable growth in air traffic. Ways to resolve air traffic increase are suggested to increase capacity and reduce delays. A number of programs to help the users save fuel are implemented: (1) local flow traffic management; (2) pilot discretion descents; (3) more frequent approval of direct routes; (4) more frequent approval of requested altitudes; and (5) unrestricted climb to altitude. These procedures allow aircraft to remain higher, longer, at the more fuel efficient altitudes. E.A.K.

N83-17527 Royal Aircraft Establishment, Farnborough (England).
DEVELOPMENT OF THE PRECISION APPROACH PATH INDICATOR LIGHT UNIT
 A. J. SMITH Jul. 1982 31 p refs
 (RAE-TM-FS(B)-483; BR84981) Avail: Issuing Activity

The Precision Approach Path Indicator (PAPI) is a simple visual aid we developed to assist pilots during approach to landing. The PAPI system uses a set of four two-color high intensity light projectors. Each beam consists of a white upper half and red lower half. The transition from one color to the other occurs over a small angle. This sharp transition is an essential feature of the

PAPI system and it is therefore important that all units should exhibit this characteristic. Similarly, operational considerations dictate the minimum beam-spread and intensity requirements for the light projectors. It is essential that the correct isocandela specification is adhered to in all PAPI units. Since the PAPI light units incorporate a projector lens it is necessary to engineer the units so as to prevent the degradation of the signal that occurs due to the presence of water droplets or ice particles on the surfaces of the lenses and any protecting windows. Various optical and engineering design parameters are reviewed, and test procedures and engineering solutions that have been developed to ensure that they are met are described. J.M.S.

05

AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

A83-19661
THE MCA METHOD, A FLIGHT TEST TECHNIQUE TO DETERMINE THE THRUST OF JET AIRCRAFT IN FLIGHT [DIE M.C.A.-METHODE, EIN FLUGVERSUCHSTECHNISCHES VERFAHREN ZUR ERMITTLUNG DES SCHUBES VON STRAHLEFLUGZEUGEN IM FLUGE]
 R. ROSENBERG and G. SCHUCH (Bundesamt fuer Wehrtechnik und Beschaffung, Manching, West Germany) Zeitschrift fuer Flugwissenschaften und Weltraumforschung, vol 6, Nov.-Dec. 1982, p. 383-390. In German.

A proposal by Casetti (1978) which uses the principle of conservation of energy to derive a relationship for thrust which includes the overall efficiency of the aircraft as a variable, is fully developed. The overall efficiency is the key to a technique (MCA or mass consumption acceleration) which allows the thrust in flight to be determined. Using the technique, relevant thrust data for various types of fighter plane lately introduced into the German air force are ascertained. The results show a scatter of about five percent. C.D.

A83-20392
A SUPERELEMENT ANALYSIS OF STIFFENED SHELLS [SUPERELEMENTNIY RASCHET PODKREPLENNYKH OBOLOCHEK]
 Z. I. BURMAN, O. M. AKSENOV, V. I. LUKASHENKO, and M. T. TIMOFEEV Moscow, Izdatel'stvo Mashinostroenie, 1982. 256 p. In Russian. refs

The theoretical principles and a general algorithm are presented for the stress analysis of fuselage-type stiffened shells. The problem is stated in a variational formulation and solved using a finite-element method, namely the superelement method. Computational algorithms are presented for the natural vibrations and the stress-strain state which allow for the effects of physical nonlinearity and loss of stability. The implementation of the computational algorithms in software is discussed in detail, with attention given to matrix operations. Some numerical and experimental results are presented. V.L.

A83-20464
THE DEVELOPMENT OF ADVANCED COMPOSITE FRONT FUSELAGE TECHNOLOGY
 M. DOOTSON and R. I. HARESCUEGH (British Aerospace Public Ltd., Co., Warton Div., Preston, Lancs., England) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 540-550.

The present investigation is concerned with design concepts and manufacturing technology associated with the use of advanced composite materials in front fuselage structures of future combat aircraft, taking into account developments in the British aerospace

industry. Four structures were chosen to represent the range of structural configurations in which the benefits of carbon fiber composites (CFC) are likely to be manifested. These structures include the Jaguar CFC wing, the Tornado CFC taileron, the Jaguar CFC engine bay door, and a CFC front fuselage. A means of manufacturing front fuselage type structures has been developed which is considered to be cost effective when compared with conventional composite construction. The advantages of this method over a fully cocured arrangement are related to less complex tooling, and the possibility to manufacture the individual components and verify them as acceptable prior to committing them to the assembly. G.R.

A83-20496

ADVANCED COMPOSITE MATERIALS IN AEROBATIC AIRCRAFT

H. D. NEUBERT (H. D. Neubert and Associates, Inc., Anaheim, CA) and L. E. LOUDENSLAGER In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 995-1002.

It is pointed out that international competitive aerobatics is a highly competitive sport in which pilots from fifteen countries participate. Currently, available and proven aircraft limit the pilot's abilities, not vice versa. For the last four years, a major effort was made to minimize the limitations found in state-of-the-art aerobatic aircraft. The new aircraft utilizes a highly optimized tubular steel fuselage, advanced composite wings, horizontal and vertical tail, landing gear legs, and secondary structure and fairings. The new fuselage design approach had two goals, related to the reduction of weight and the satisfaction of structural requirements. Attention is given to aspects of wing fabrication, the empennage, and the landing gear legs. G.R.

A83-20598#

TECHNOLOGY AND MODERN FIGHTER AIRCRAFT - THE EVOLUTIONARY F-16

H. J. HILLAKER (General Dynamics Corp., Fort Worth, TX) AIAA Student Journal, vol. 20, Fall 1982, p. 8-11, 47.

Details are given of the design features and performance characteristics of three F-16 fighter variants: the F-16/79 export version, which is powered by the J79-GE-119 engine; the F-16XL, which incorporates cranked arrow wings for greater internal fuel volume and weapons carriage; and the Advanced Fighter Technology Integration F-16, which has undertaken research into novel control surface, avionics and automated flight control concepts. Attention is also given to the preliminary design concept development of the F-16, during which the criteria for the versatility and long-term modification of the aircraft were formulated. O.C.

A83-20599#

NGT - THE NEXT GENERATION TRAINER

G. ROSENTHAL (Fairchild Republic Co., Farmingdale, NY) AIAA Student Journal, vol. 20, Fall 1982, p. 22-27.

An account is given of the design development history, wind tunnel configuration tests, and performance characteristics of the Fairchild Republic Company's Next Generation Trainer (NGT) aircraft. With the rise in fuel prices over the last decade, a strong incentive existed to exploit the fuel efficiency advantages of state-of-the-art turbofan engines as well as recent developments in airfoil technology which offered improved lift/drag ratios. Further economies were desired in aircraft maintainability and durability. The NGT's primary structure is of aluminum alloy, and the secondary structures include both nonmetallic and metal composites. The development process of the NGT proceeded from the selection of the TFE 76-4A engine, to wind tunnel and radio control tests, and finally the construction of both a full-scale engineering mock-up and an 0.62-scale demonstrator aircraft for flight testing. O.C.

A83-20600#

THIRTY YEARS OF FIGHTER ARMAMENT

L. NORDEEN (McDonnell Aircraft Co., St. Louis, MO) AIAA Student Journal, vol. 20, Fall 1982, p. 32-37.

An historical account is given of the development of fighter aircraft armament for air-to-air engagements from World War II to the present, with attention to the relative advantages of guided missiles and rapid fire 20- and 30-mm cannon in various speed, range, and altitude regimes. Lessons are drawn from fighter engagements in the Korean War, Vietnam, and the 1973 Arab-Israeli war, and the recent Falkland Islands conflict. The effectiveness of contemporary U.S. Air Force armaments is illustrated by the experience of the F-15- and F-16-equipped Israeli Air Force in air combat over Lebanon in June 1982, where AIM-9L IR-homing missiles and AIM-7F/M Sparrow missiles downed 85 Syrian MiG-21s and MiG-23s without the loss of a single aircraft. O.C.

A83-21005#

EFFECTIVE AERODYNAMIC PARAMETER EVALUATION FROM FREE FLIGHT TESTS

Y. SYLMAN and R. GRANOT (Israel Military Industries, Rocket Systems Div., Tel Aviv, Israel) In: Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers. Haifa, Technion - Israel Institute of Technology, 1982, p. 29-36. refs

A method was developed capable to reduce the principal force coefficients using a modestly instrumented range. A new fixed camera calibration procedure and algorithm are presented, where the calibrated parameters are physically meaningful on their own. Using a mathematical model suited specifically to the rocket system, a maximum likelihood technique optimizes the model parameters by fitting device-measured quantities. Following this approach, the information can be handled in cases where conventional trajectory reduction methods do not work. The evaluated parameters came out to be very similar for uncorrelated flights and the simulated trajectories are in good agreement with the measured data. The implementation of fixed cameras in the instrumentation setup contributes to improved accuracy in the estimated parameters. (Author)

A83-21017#

THE AEROELASTIC BEHAVIOR OF CURVED HELICOPTER BLADES IN HOVERING AND AXIAL FLIGHT

A. ROSEN and O. RAND (Technion - Israel Institute of Technology, Haifa, Israel) In: Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers. Haifa, Technion - Israel Institute of Technology, 1982, p. 129-139. refs

A theory which describes the aeroelastic behavior of curved elastic blades in hovering and axial flight is derived. The model is capable of dealing with any planform of the elastic axis and any spanwise distribution of the blade properties. The loads which act on the blade include gravity, inertia and aerodynamic contributions. The aerodynamic loads are calculated by using the blade element theory which has been extended to include also blades with curved axis. The numerical examples include three different hingeless blades. The properties of all the blades are identical except from the shape of the elastic axis. While one blade has a straight elastic axis the other two have curved elastic axes. The elastic deformations and load distributions along the blades are presented and discussed. It is shown that the different curvature distributions have significant influence on the aeroelastic behavior of the blades. (Author)

A83-21025#

A SIMPLIFIED MODEL OF THE INFLUENCE OF ELASTIC PITCH VARIATIONS ON THE ROTOR FLAPPING DYNAMICS

A. ROSEN and Z. BEIGELMAN (Technion - Israel Institute of Technology, Haifa, Israel) In: Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers. Haifa, Technion - Israel Institute of Technology, 1982, p. 225-237. refs

The well known model of a rigid blade with an offset hinge and torsional spring, which is often used to describe the flapping dynamics of helicopter rotors, is extended here to include also elastic torsional pitch variations due to the torsional flexibility of the blades and the control system. The model is capable of dealing with blades which have nonuniform properties along them and nonuniform induced velocity distribution over the disc. The derivation leads to a system of nine coupled ordinary differential equations in the nine unknowns which describes the tip path plane and the elastic torsion dynamics. This system is especially suitable for use in cases where helicopter stability and control problems are of interest. A few numerical examples show the use of the model and the influence of different parameters, like cross-sectional aerodynamic and center of mass locations, on the torsional and flapping dynamics of rotors. (Author)

A83-21032

OPERATOR INFLUENCES ON AIRCRAFT DESIGN

J. G. BORGER Vertiflite, vol. 29, Jan.-Feb. 1983, p. 14-18.)

In view of the interaction between airlines and manufacture which resulted in the formulation of the primary design characteristics of the 747 aircraft, a series of recommendations are presented on the design criteria for which users may serve as the most significant choice in helicopter design. Attention is given to payload-range considerations and the roles of engine choice and weight control. It is recommended that prospective users of the aircraft undergoing design development insist on a payload-range mission guarantee, as well as a demonstration of compliance with all guarantees. O C

A83-21033

THE HUMMERCRAFT

R. E. REED (Hughes Helicopters, Inc., Culver City, CA) Vertiflite, vol. 29, Jan.-Feb. 1983, p. 25-27.

While the 'Hummercraft' helicopter configuration concept described operates on the proven principle of rotor control of lift and direction, it incorporates a stabilizing gyroscopic platform which opposes the unstable rolling and pitching reaction modes that inhere in current helicopter designs. The hummercraft is driven by engine reaction from two small thrust-producing engines (such as small turbojets) that are diametrically opposed, and turn at an optimum radius. The structural system connecting the two engines is in turn secured to a collar, which rotates about a fixed mast. The fuel tank, in the form of a large disk, rotates with this structural system. The Hummercraft configuration obviates transmission geartrains, tail booms and tail rotors, thereby needing only 20% of the moving parts of a conventional helicopter. O.C.

A83-21349

THE FOKKER F28 AND A FOUR-ENGINED NEWCOMER

Aircraft Engineering, vol. 55, Jan. 1983, p. 10-14.

Data on the performance of the F28 and the BAe 146 are compared. It is found that over a typical short-haul sector of 200 nm the F28 burns 12% to 30% less fuel than the 146, depending on the version of the 146 considered, the payload, and the flight plan. The airframe and engine maintenance costs of the 146 exceed those of the F28 by 40%. The overall engine maintenance cost of the 146 is found to be at least 66% greater than that of the F28. With a full payload of 85 passengers, the F28 has a range more than twice that of the standard 146-100 carrying 82 passengers. In addition, the F28 has a multihop capability that is far superior to that of the 146. With both aircraft flying at Mach 0.65 over a typical short-haul network of 200 nm, the F28 is found to burn 1345 kg of fuel and the 146 1665 kg, or 24% more. C.R.

A83-21574

WILL TECHNOLOGY MAKE THE HELICOPTER COMPETITIVE

P. CONDOM Interavia, vol. 38, Feb. 1983, p. 119, 120.

A discussion is presented concerning the technological development factors which will most directly influence the ability of commercial helicopters to expand their market into that of specialized, STOL regional transport aircraft. Raising the profitability of the helicopter depends on reducing manufacturing and maintenance costs and increasing useful load and flight performance. The simplest method of improving the payload capacity of helicopters is to reduce their empty weight, through the use of advanced composite materials such as Kevlar/epoxy. Composite primary structures are also simpler than metallic ones, thereby reducing both manufacturing costs and maintenance and repair costs. Further savings are anticipated in rotor transmissions and in fly-by-wire electronic flight controls and digital avionics. To become competitive with airliners, cost/passenger seat figures must drop from the present \$180,000-270,000 to \$75,000-90,000. O.C.

A83-21771

DAMAGE TOLERANCE ASSESSMENT OF THE A-7D AIRCRAFT STRUCTURE

D. J. WHITE and T. D. GRAY (Vought Corp., Dallas, TX) In: Advances in fracture research; Proceedings of the Fifth International Conference on Fracture, Cannes, France, March 29-April 3, 1981. Volume 5. Oxford, Pergamon Press, 1982, p. 2127-2136. refs

A fracture mechanics assessment was carried out on the A-7D Corsair II fighter structure to ensure that the aircraft would have an 8000 hr flight use lifetime. A preliminary damage tolerance assessment identified the potentially critical structural areas in the airframe. Data from the A-7D stress and fatigue analysis, static and fatigue test results, service experience, and nondestructive inspection were employed. Samples were cut from the lower wing skin of an A-7D that had 690 flight hours, and fatigue testing was carried out until cracks developed. Fractographic and statistical analyses were performed on the flaws produced. The resulting baseline stress spectra were used to define the operational limits and the inspection requirements of the aircraft for the twenty critical structural items found in the initial evaluation. The A-7D was concluded structurally capable of 8000 hr of operational flight time. M.S.K.

A83-22155#

DESIGN, ANALYSES, AND MODEL TESTS OF AN AEROELASTICALLY TAILORED LIFTING SURFACE

W. A. ROGERS, W. W. BRAYMEN (General Dynamics Corp., Fort Worth, TX), and M. H. SHIRK (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) Journal of Aircraft, vol. 20, Mar. 1983, p. 208-215. USAF-sponsored research. refs

(Previously cited in issue 22, p. 3811, Accession no. A81-45974)

A83-23220#

A SIMULATION MODEL FOR THE ANALYSIS OF THE DYNAMIC BEHAVIOR OF A HELICOPTER ROTOR UNDER NONSTATIONARY LIMIT FLIGHT CONDITIONS [MODEL SYMULACYJNY DYNAMIKI WIRNIKA SMIGLOWCA W GRANICZNYCH, NIEUSTALONYCH STANACH LOTU]

K. SZUMANSKI Instytut Lotnictwa, Prace, no. 89, 1982, p. 3-59. In Polish. refs

Taking the elastic properties of the rotor blades and their mountings into consideration, it is possible to investigate rotors of various types. Allowing for the nonstationariness, the three-dimensional character, and the compressibility of the flow past the rotor blades over the entire range of angles of attack, the dynamics of a helicopter rotor under the limiting flight conditions can be investigated, together with the aeroelastic phenomena involved. By superposing free perturbations of flow past the rotor blades, it is possible to take into account the proximity of the fuselage, the influence of the wake behind the rotor, and the turbulence of the atmosphere. This also facilitates the solution of

problems concerning the interference of other elements having the form of a lifting surface or rotor. C.R.

A83-23247#

THEORETICAL AND EXPERIMENTAL STUDY OF HELICOPTER ROTOR NOISE

S. LEWY (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) and M. CAPLOT ONERA, TP no. 1982-74, 1982. 15 p. refs

(ONERA, TP NO. 1982-74)

The present state of theoretical and experimental studies concerning helicopter rotor noise, as conducted at ONERA, is described. Theoretical models for the prediction of acoustic spectra are discussed, and the contribution of wall pressure fluctuations on the blades to the broadband noise is experimentally investigated in a wind tunnel at transonic Mach numbers. It is found that results under incompressible conditions should not be extrapolated to the compressible domain. The rotor-vortex interaction for two-bladed and four-bladed rotors is also studied in the wind tunnel. Thickness noise is calculated for a blade cross section of about seven square cm, using as fundamental parameters the rotor tip Mach number, the advance ratio, the reduced thrust coefficient, and the angle of inclination. Comparison of calculation with experiment suggests that the acoustic phenomena related to transonic velocities on the advancing blade tip are not yet modeled in a satisfactory manner. C.D

A83-23249#

BO 105 ROTOR BLADE INFLUENCE ON THE CALIPSO FLIR IN THE MAST-MOUNTED OBSERVATION PLATFORM OPHELIA

H.-D. V. BOEHM (Messerschmitt-Bolkow-Blohm GmbH, Munich, West Germany) Association Aeronautique et Astronautique de France, European Rotorcraft Forum, 8th, Aix-en-Provence, France, Aug. 31-Sept. 3, 1982, Paper. 19 p.

It is noted that the FLIR has two fields of view and a serial-parallel scan mechanism. When the stabilized platform containing the FLIR is directed downward in flight at an elevation of -10.4 deg to look through the main rotor blades, the effect of the blades on the thermal image can be seen in the center of both fields of view. A theoretical discussion based on the geometry of the total system is given, considering first the static and then the dynamic case. It is found from flight tests and the theoretical discussion that, for this combination, the rotor blade influence on both fields of view is relatively insignificant. The background thermal image remains virtually unobscured under the influence of the rotor blade. Also discussed is the rotor blade influence on different types of FLIR systems. C.R.

N83-16326

Royal Aircraft Establishment, Farnborough (England).

FLYING AND DESIGN OF AIRCRAFT

J. C. WANNER Nov. 1981 18 p refs Transl. into ENGLISH from Aeron. et Astron. (France), vol. 40, 1973 p 10-18 (RAE-TRANS-2070; BR85535) Avail: Issuing Activity

Technical specifications for the Concorde were reviewed in order to ensure the safety of its missions. Most of the old rules of thumb generally used for the conventional aircraft appeared as obsolete or unapplicable to a supersonic transport. In order to develop the definition of these regulations, a theoretical method was developed for evaluating the reliability of these manned aerospace vehicles. This method called ESAU, is based on an investigation of the occurrence of accidents. An accident is due to a set of incidents which can be classified into only three different types. The study of each type of incident, and the probability of occurrence, which has to be reduced in order to increase the safety, is very useful to the designer of a project when choosing between possible solutions, taking into account the reliability of the systems, the possibility human errors, and flight conditions. S.L.

N83-16327 Aeronautical Research Labs., Melbourne (Australia). Mechanical Engineering Dept.

COCKPIT TEMPERATURES AND COOLING REQUIREMENTS OF A PACKED AIRCRAFT

N. J. REPACHOLI and B. REBBECCHI Nov. 1981 27 p refs (ARL-MECH-ENG-NOTE-388; AR-002323) Avail: Issuing Activity

The cockpit and metal surface temperatures of a parked Sabre aircraft exposed to high air temperatures and solar radiation loads. Results were obtained both with and without cooling air supplied to the cockpit; these results have been used to formulate a mathematical model of the cockpit heat balance. Author

N83-16328*# National Aeronautics and Space Administration, Washington, D. C.

THE HALF-MODEL TECHNIQUE IN THE WIND TUNNEL AND ITS EMPLOYMENT IN THE DEVELOPMENT OF THE AIRBUS FAMILY

H. P. FRANZ Aug. 1982 38 p refs Transl. into ENGLISH of "Die Halbmodelltechnik im Windkanal und ihre Anwendung bei der Entwicklung der Airbus-Familie" rept. DGLR-Paper-81-118 Deutsche Gesellschaft fuer Luft- und Raumfahrt, Aachen, 11-14 May 1981 p 1-38 Previously announced in IAA as A81-47587 Transl. by Scientific Translation Service, Santa Barbara, Calif. (Contract NASW-3542)

(NASA-TM-76970; NAS 1.15:76970; DGLR-PAPER-81-118)

Avail. NTIS HC A03/MF A01 CSCL 01C

For abstract see A81-47587.

N83-16329*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.

AN ON-BOARD NEAR-OPTIMAL CLIMB-DASH ENERGY MANAGEMENT Interim Report

A. R. WESTON, E. M. CLIFF, and H. J. KELLEY Dec 1982 122 p refs

(Contract NAG1-203)

(NASA-CR-169755; NAS 1.26:169755) Avail: NTIS HC A06/MF A01 CSCL 01C

On-board real time flight control is studied in order to develop algorithms which are simple enough to be used in practice, for a variety of missions involving three dimensional flight. The intercept mission in symmetric flight is emphasized. Extensive computation is required on the ground prior to the mission but the ensuing on-board exploitation is extremely simple. The scheme takes advantage of the boundary layer structure common in singular perturbations, arising with the multiple time scales appropriate to aircraft dynamics. Energy modelling of aircraft is used as the starting point for the analysis. In the symmetric case, a nominal path is generated which falls into the dash or cruise state. Feedback coefficients are found as functions of the remaining energy to go (dash energy less current energy) along the nominal path. S.L.

N83-16330*# Boeing Commercial Airplane Co., Seattle, Wash. **ADVANCED COMPOSITE ELEVATOR FOR BOEING 727 AIRCRAFT, VOLUME 2 Final Report**

D. V. CHOVIL, W. D. GRANT, E. S. JAMISON, H. SYDER, O. E. DESPER, S. T. HARVEY, and J. E. MCCARTY Nov. 1980 405 p refs

(Contract NAS1-14952)

(NASA-CR-159258; NAS 1.26:159258) Avail: NTIS HC A18/MF A01 CSCL 01C

Preliminary design activity consisted of developing and analyzing alternate design concepts and selecting the optimum elevator configuration. This included trade studies in which durability, inspectability, producibility, reparability, and customer acceptance were evaluated. Preliminary development efforts consisted of evaluating and selecting material, identifying ancillary structural development test requirements, and defining full scale ground and flight test requirements necessary to obtain Federal Aviation Administration (FAA) certification. After selection of the optimum elevator configuration, detail design was begun and included basic configuration design improvements resulting from manufacturing verification hardware, the ancillary test program, weight analysis, and structural analysis. Detail and assembly tools were designed

and fabricated to support a full-scope production program, rather than a limited run. The producibility development programs were used to verify tooling approaches, fabrication processes, and inspection methods for the production mode. Quality parts were readily fabricated and assembled with a minimum rejection rate, using prior inspection methods. Author

N83-16331*# Sikorsky Aircraft, Stratford, Conn.
PREDESIGN STUDY FOR A MODERN 4-BLADED ROTOR FOR THE RSRA Final Report
 S. J. DAVIS Mar. 1981 177 p refs
 (Contract NAS2-10691)
 (NASA-CR-166155; NAS 1.26:166155) Avail: NTIS HC A09/MF A01 CSDL 01C

A predesign study was conducted to evaluate the feasibility of providing a modern four bladed rotor for flight research testing on NASA's Rotor System Aircraft. The objectives of the proposed tests are to acquire data (for correlation purposes) on the capabilities of a state of the art rotor system and to quantify the contributions of key design parameters to these capabilities. Three candidate rotors were examined: the UH-60A BLACK HAWK rotor with and without root extenders and the H-3 Composite Blade rotor. It was concluded that the technical/cost objectives could best be accomplished using the basic BLACK HAWK rotor (i.e., without root extenders). Further, the availability of three existing sets of blade tip of varying design, together with a demonstrated capability for altering airfoil geometry should provide early research information on important design variables at reduced cost. For planning purpose it is estimated that the proposed rotor system could be available for testing in 24 months after authorization to proceed for a cost of \$6.098 million. Author

N83-16332# Calspan Corp., Buffalo, N. Y.
IN-FLIGHT INVESTIGATION OF LARGE AIRPLANE FLYING QUALITIES FOR APPROACH AND LANDING Interim Technical Report, Apr. 1980 - Jul. 1981
 N. C. WEINGARTEN and C. R. CHALK Wright-Patterson AFB, Ohio AFWAL Sep. 1981 484 p refs
 (Contract F33615-79-C-3618; AF PROJ 2403)
 (AD-A120202; C-6645-F-5; AFWAL-TR-81-3118) Avail: NTIS HC A21/MF A01 CSDL 01C

A study of the handling qualities of large airplanes in the approach and landing flight phase was performed. An in-flight simulation experiment utilizing the USAF-AFWAL/Calspan Total In-flight Simulator was carried out to gather data for the analysis effort. A one-million pound statically unstable airplane model was used as a baseline about which variations were made. The primary variables were relative pilot position with respect to center of rotation, command path time delays and phase shifts, augmentation schemes and levels of augmentation. Both longitudinal and lateral-directional characteristics were investigated. The experiment design, conduct of the experiment, and analysis of the data are described. Results are presented in the form of pilot ratings, pilot comments and various analysis techniques. The results indicate that the approach and landing task with very large airplanes is a fairly low bandwidth task. Low equivalent short-period frequencies and relatively long time delays can be tolerated. As the pilot position is moved aft towards and then behind the center of rotation, pilot ratings are degraded. A multiloop analysis of pitch attitude and altitude control gave insight into this pilot position phenomenon. GRA

N83-16334# Performance Measurement Associates, Inc., Vienna, Va.
PERFORMANCE MEASURES FOR AIRCRAFT CARRIER LANDINGS AS A FUNCTION OF AIRCRAFT DYNAMICS Final Technical Report, 23 Sep. 1980 - 22 Jan. 1982
 E. M. CONNELLY Jan. 1982 86 p refs
 (Contract N61339-80-C-0132)
 (AD-A120473; PMA55-1-81; NAVTRAEQUIPC-80-C-0132-1)
 Avail: NTIS HC A05/MF A01 CSDL 01B

A theory of performance measurement for operator controlled systems is presented. The theory permits synthesis of a system

performance on successive data samples based on the impact of the sampled performance on the overall summary of performance. The dynamics of the controlled element, i.e., the aircraft, are effectively removed from the measurement even though the pilot (operator) continues to control the aircraft. This report documents the development of measures for aircraft carrier landings for the glide path and angle of attack control channels. In addition to the aircraft carrier landing problems, an application of system performance measures to air to ground weapons launch problems were analyzed. The weapon launch problem is characterized by the existence of a release hyper surface from which a high probability of kill can be expected. Thus, the problem is not characterized as having necessarily a single path which must be flown to a weapons release point, but rather, a confluence of paths exist which proceed to the release hyper surface. A method for developing a summary measure for the weapons release problem is presented along with an outline of the method of synthesizing the associated system performance measure. Finally, a comparison of the nature and applications of linear pilot models and system performance measures is developed. GRA

N83-16335# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Unternehmensbereich Drehfluegler.
SURVEY OF ACTIVE AND PASSIVE MEANS TO REDUCE ROTORCRAFT VIBRATIONS
 G. REICHERT and H. STREHLOW 1 Oct. 1981 24 p refs
 Presented at DGLR Symp. on Aeroelasticity, Nuernberg, West Germany, 5-7 Oct. 1981 Previously announced in IAA as A82-37946
 (MBB-UD-350) Avail: Issuing Activity
 For abstract see A82-37946.

N83-16336# Bristol Univ. (England). Dept. of Aeronautical Engineering.
HELICOPTER FIN EFFECTIVENESS B.S. Thesis
 G. A. JOHNSON and C. M. WU Jun. 1982 58 p refs
 (BU-271) Avail: NTIS HC A04/MF A01

The nature of fin ineffectiveness in helicopters of WG30 type was explored. A one-fifth scale model of the early Westland Lynx helicopter was used, with suitable upsweep modifications to simulate the WG30. Wind tunnel tests were carried out to measure the yawing moments using the balance for cases of fin on and fin off, and wake surveys using yawmeters around the fin for various fuselage configurations and pitch-yaw combinations. Diagrams of flow angles and isodynamic contours were constructed and flow visualization tests were made. It is concluded that the loss of fin effectiveness is caused by wake shed from the upper fuselage rather than from the lower part. The loss increases with pitch incidence. The change in flow angles seen by the fin and dynamic pressure losses, which fell short of the free stream value by factors of 0 to 0.5, are both important. The values of yawing moment due to the fin from balance and from pressure measurements correlate well with each other. Author (ESA)

N83-16337# Bristol Univ. (England). Dept. of Aeronautical Engineering.
DESIGN CONSIDERATIONS FOR THE CONSTRUCTION OF A SHERIFF WING IN COMPOSITE MATERIALS B.S. Thesis
 D. M. POWELL and J. P. WEISS Jun. 1982 54 p refs
 (BU-280) Avail: NTIS HC A04/MF A01

The state of the art of aircraft construction using composites is reviewed, and the design of a composite wing for the Sheriff twin engine light training aircraft is considered. The major problems associated with composites are: lack of knowledge of long term material properties; difficulty in joining the materials; methods of testing for cracks and internal failure, and the lack of a suitable choice of safety factors to apply to known strengths. Conventional aluminum alloy structures cannot be made in fiber composites merely by substitution of materials. The design must be reappraised, emphasizing loading specification, stiffness, safety factors, size, and material selection. Careful choice of filament orientation and lay-up must be made to ensure that the major loads are carried

by the fibers, minimizing damaging effects of out of plane loads.
Author (ESA)

N83-17458# Peat, Marwick, Mitchell and Co., San Francisco, Calif.

AIRCRAFT TOWING FEASIBILITY STUDY

H. S. L. FAN and D. G. HANEY *In* DOE Symp. on Com. Aviation Energy Conserv. Strategies p 45-56 Apr. 1981 refs Avail: NTIS HC A17/MF A01 CSCL 01B

The feasibility and constraints of towing aircraft between runways and terminal gate areas as a fuel conservation measure were studied.
Author

N83-17528# National Aerospace Lab., Tokyo (Japan). Flight Analysis Team.

FLIGHT SIMULATION TEST OF NATIONAL AEROSPACE LABORATORY STOL-RESEARCH-AIRCRAFT. PART 1: STOL CONFIGURATION

1982 163 p refs *In* JAPANESE; ENGLISH summary (NAL-TR-713-PT-1; ISSN-0389-4010) Avail: NTIS HC A08/MF A01

A fixed-base visual simulation study has been conducted to evaluate the airworthiness and the flying quality of the NAL Quiet fan-jet STOL Research Aircraft having a high wing and equipped with a upper surface blowing flap in combination with four high bypass-ratio fan-jet engines. Real-time digital simulation techniques were used. The computer was programmed with equations of motion for six degrees of freedom and the aerodynamic inputs were based on measured wind-tunnel data. A visual display of a STOL airport was provided for simulation of the flare and touch down characteristics. Flight missions to be executed by pilots are: (1) approach and landing, (2) engine failure, (3) approach to stall and recovery and (4) take-off. The airworthiness and flying quality of NAL QSRA were evaluated by pilot opinion and rating, the observation and analysis of time history and the many statistical data recorded during the simulation.
Author

N83-17529# National Aerospace Lab., Tokyo (Japan). GENERAL PURPOSE FLIGHT SIMULATION PROGRAM (FSPK-1). PART 1: CONTENTS OF THE PROGRAM

T. BANDO and A. WATANABE Feb. 1982 66 p refs *In* JAPANESE; ENGLISH summary (NAL-TR-702; ISSN-0389-4010) Avail: NTIS HC A04/MF A01

The FSPK-1 simulation program which simulates large nonlinear aircraft motion and is intended as an integrated design tool in the development of an aircraft is discussed. It was used in the simulation tests for quiet-STOL experimental aircraft to demonstrate its effectiveness. Characteristics, advantages, and limitations include (1) an operation based on the fixed point method with the objective aircraft limited to a medium subsonic aircraft of moderate motion, (2) high general applicability, (3) an aerodynamic model of the program, with empenage contributions with nonlinearity independently calculated, (4) the effect of aircraft motion on engine failure accurately evaluated by an engine failure conversion coefficient, (5) an automatic trim capability to start the simulation at any flight point, (6) independent calculation for control response and gust response etc., and (7) a fixed based cockpit.
S.L.

N83-17530*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PERFORMANCE OF HIGH-ALTITUDE, LONG-ENDURANCE, TURBOPROP AIRPLANES USING CONVENTIONAL OR CRYOGENIC FUELS

G. C. LIU, C. E. K. MORRIS, JR., and R. W. KOENIG Jan. 1983 54 p refs (NASA-TM-84534; NAS 1.15:84534) Avail: NTIS HC A04/MF A01 CSCL 01C

An analytical study has been conducted to evaluate the potential endurance of remotely piloted, low speed, high altitude, long endurance airplanes designed with 1990 technology. The baseline configuration was a propeller driven, sailplane like airplane powered by turbine engines that used JP-7, liquid methane, or liquid hydrogen as fuel. Endurance was measured as the time spent between

60,000 feet and an engine limited maximum altitude of 70,000 feet. Performance was calculated for a baseline vehicle and for configurations derived by varying aerodynamic, structural or propulsion parameters. Endurance is maximized by reducing wing loading and engine size. The level of maximum endurance for a given wing loading is virtually the same for all three fuels. Constraints due to winds aloft and propulsion system scaling produce maximum endurance values of 71 hours for JP-7 fuel, 70 hours for liquid methane, and 65 hours for liquid hydrogen. Endurance is shown to be strongly effected by structural weight fraction, specific fuel consumption, and fuel load. Listings of the computer program used in this study and sample cases are included in the report.
Author

N83-17531# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

A CONTROL MODEL FOR MANEUVERING FLIGHT FOR APPLICATION TO A COMPUTER FLIGHT TESTING PROGRAM

H. HAVERDINGS 31 Jul. 1981 18 p refs Presented at 7th European Rotorcraft and Powered Lift Aircraft Forum, Garmisch-Partenkirchen, West Ger., 8-11 Sep. 1987 Sponsored by Royal Netherlands Air Force Directorate of Material (NLR-MP-81046-U) Avail: NTIS HC A02/MF A01

A computer-flight-testing (CFT) program for helicopters was developed to evaluate helicopter dynamics and handling and control qualities. The nonlinear 6 degrees of freedom helicopter model is driven by control inputs by a specially developed control model (or pseudo pilot). This is an adaptation of a linear optimal control model as used in human factor analysis. The helicopter model is based on two dimensional strip aerodynamics and steady-state rotor blade dynamics using only out-of-plane bending mode shapes, which are suitable for various types of rotor articulation. The pilot model consists of a flight path generation (FPG) model and a stabilization (STAB) model. The FPG model is based on linearized system dynamics using terminal optimal control, generating both the required flight path and the control inputs to achieve it. These controls are input into the helicopter model. The two flight paths are compared, and differences are fed back to the STAB model to generate corrective control inputs of such a nature that the helicopter-model-generated flight path tracks the required flight path generated by the FPG model. Also the STAB model is based on linearized system dynamics. As an example, two flare maneuvers are 'flown', and the results discussed. The pseudo-pilot model performs well, provided that helicopter dynamics do not change much during a specific maneuver.
J.M.S.

N83-17532# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

PREDICTED AND MEASURED LANDING GEAR LOADS FOR THE NF-5 AIRCRAFT TAXIING OVER A BUMPY RUNWAY

H. H. OTTENS 28 Jan. 1982 18 p refs Presented at 54th AGARD Struct. and Mater. Panel, Brussels, 4-9 Apr. 1982 (Contract RB-KLU 1980-P59)

(NLR-MP-82008-U) Avail: NTIS HC A02/MF A01

A simple mathematical model of the NF-5A aircraft was developed. The model is validated by measured results. Landing gear loads are calculated for the aircraft taxiing across a repaired runway using an AM-2 mat. The results depend strongly on the heaving and pitching motion of the aircraft when it meets the repair.
E.A.K.

N83-17533# Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany). Information and Dokumentation.

THE USE OF HELICOPTERS IN EUROPE: ANALYSIS AND PROSPECTS [HUBSCHRAUBEREINSATZ IN EUROPA: ANALYSE UND AUSBLICK]

L. BOELKOW 1982 20 p refs *In* GERMAN Presented at 14th Intern. Hubschrauberforum Bueckeburg, Hannover, 21 May 1982

(MBB-UD-359/82-O) Avail: Issuing Activity

The use of helicopters for civil applications in Europe is treated. In the period from 1974 to 1980 the number of civil helicopters in

the countries of the European Community increased by 87%. The reasons for this increase are explained. Civil helicopters are very reliable; the average number of accidents is comparable with that of general civil aviation. Helicopters types used in Europe and the US are compared. An increase in use is predicted, although due to its limited speed the helicopter cannot be used economically for distances larger than 600 km. Author (ESA)

N83-17759# Joint Publications Research Service, Arlington, Va. **ATR 42 WILL HAVE ULTRAMODERN, INNOVATIVE COCKPIT, AVIONICS**
S. BROSELIN In its West Europe Rept.: Sci. and Technol., No. 133 (JPRS-82608) p 19-22 10 Jan. 1983 Transl. into ENGLISH from Aviation Mag. Intern (France), 1 Nov. 1982 p 38-39

Avail: NTIS HC A03/MF A01

The idea of regional aviation has considerably broadened, if only in the area of its capacities. It is not less evident that above and beyond the special operational needs, the 20- to 30-seat categories on one hand and the 40- to 60-seat categories on the other hand correspond to distinct and clearly defined commercial needs. It is the latter category which the ATR-42 is planned for, an ambitious operation envisioning a vast and promising potential market, and, what is more, brought forth by two builders who have considerable resources. Author

06

AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

A83-20390
ELECTRICAL, AVIONIC, AND SENSOR EQUIPMENT OF THE YAK-40 AIRCRAFT /2ND REVISED AND ENLARGED EDITION/ [AVIATIONNOE I RADIOELEKTRONNOE OBOURODOVANIIE SAMOLETA IAK-40 /2ND REVISED AND ENLARGED EDITION/]

I. E. BONDARCHUK and V. I. KHARIN Moscow, Izdatel'stvo Transport, 1982. 272 p. In Russian.

Basic technical information about the electrical, avionic, and sensor equipment of the YAK-40 aircraft is presented, with emphasis on in-flight operations. Particular consideration is given to dc energy sources, ac networks, and electric equipment for powerplant control, power conditioning and antiicing, and signaling and lighting. Also considered are radio communication and navigation equipment, the meteorological radar station, guidance and navigation sensors, and engine-monitoring sensors. B.J.

A83-20849
THE AUTOMATED COCKPIT

E. J. LERNER IEEE Spectrum, vol. 20, Feb. 1983, p. 57-62.

Reference is made to the savings in fuel made possible by automation. From the pilot's point of view, all information on the plane's relation to its surroundings at any instant is concentrated mainly on two video screens: a horizontal situation indicator and an attitude direction indicator. The internal status of the plane, including the vital engine indicators, is followed on two other electronic screens. The crew has access to the flight-management computers through a control display unit. The pilot or copilot can enter a flight plan through the keyboard, ask the computer to suggest optimum profiles for climb, cruising altitude, and descent, and request the plotting of courses to a specific geographic point. An account is also given of the way in which the dispute over crew size was settled in the United States. C.R.

A83-22163*# Ideal Research, Inc., Rockville, Md.
MICROWAVE ICE ACCRETION MEASUREMENT INSTRUMENT /MIAMI/

B. MAGENHEIM and J. K. ROCKS (Ideal Research, Inc., Rockville, MD) Journal of Aircraft, vol. 20, Mar. 1983, p. 262-266. NASA-sponsored research.

(Previously cited in issue 06, p. 812, Accession no. A82-17875)

A83-22492* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.
FIBER OPTIC WAVELENGTH MULTIPLEXING FOR CIVIL AVIATION APPLICATIONS

Fiber optic wavelength multiplexing for civil aviation applications. H. D. Hendricks, J. L. Spencer, and C. J. Magee (NASA, Langley Research Center, Hampton, VA). In: Fiber optics in adverse environments; Proceedings of the Seminar, San Diego, CA, August 25-27, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 134-140. refs

Research is being conducted to accelerate the acceptance of advanced technologies by the airframe manufacturers. These technologies will make the aircraft of the 1990-2000 period more efficient and less expensive to operate. The implementation of advanced control functions requires the employment of suitable onboard flight electronics systems. The present investigation is concerned with a concept for reliable onboard data distribution which is focused around the use of fiber optic wavelength division multiplexing (WDM). Attention is given to aircraft control and data distribution, the wavelength division multiplexing data bus, semiconductor lasers and optical transmitters, an optical coupler-multiplexer, and optical demultiplexers. Results of tests on the prototype WDM systems indicate that the WDM concept can be engineered into a successful system with currently available components. G.R.

A83-22502
MULTIFUNCTION CO2 LASER RADAR TECHNOLOGY

R. L. DEL BOCA and R. J. MONGEON (Coherent Laser Systems, Inc., South Windsor, CT) In: Physics and technology of coherent infrared radar; Proceedings of the Meeting, San Diego, CA, August 25, 26, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 19-32. Army-sponsored research. refs

Developments during the past decade have demonstrated coherent CO2 laser radar technology for a variety of military applications. The feasibility of incorporating heterodyning CO2 laser radars in airborne scenarios has been demonstrated for wire detection, terrain sensing, and high resolution 3 axis Doppler velocity sensing for navigation and hover. Additional multifunction capabilities for target discrimination and weapon guidance have been investigated and are undergoing further developments. This paper surveys the military applications, hardware configurations, results of flyable prototypes, and the technology status of multifunction CO2 laser radars. (Author)

A83-22521
ADAPTIVE DETECTION OF TARGETS IN LASER SPECKLE NOISE

R. J. BECHERER (MIT, Lexington, MA) In: Physics and technology of coherent infrared radar; Proceedings of the Meeting, San Diego, CA, August 25, 26, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 200-206. USAF-sponsored research. refs

This paper analyzes the detection process for targets in laser speckle noise using results from classical detection and estimation theory. The analysis is applied to the real problem of an airborne laser radar system looking down at targets on the ground. An optimum strategy for adaptive signal processing is described and graphical results are presented to facilitate laser radar system design. (Author)

A83-22578

FUTURE TRENDS IN THE USE OF INFRARED LINE SCANNERS FOR AIRBORNE RECONNAISSANCE

W. MCCracken (Honeywell Electro-Optics Operations, Lexington, MA) In: Airborne reconnaissance V; Proceedings of the Seminar, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1981, p. 24-28.

By considering a hypothetical future nonnuclear warfare scenario, it is shown that infrared line scanners (IRLS) can play a vital role because of their wide field strip-map coverage, their ability to handle high V/H ratios, and their ability to see through low lying fog beneath the aircraft. Near-term (to 1985), mid-term (to 1990), and far-term (to 1995 and beyond) development trends are briefly reviewed to show how IRLS systems are evolving to meet the new requirements of lower altitude, higher V/H, oblique viewing, rapid film interpretation, bandwidth compression, data linking, target screening, and synergistic combinations with laser and microwave scanners. Some new data-processing and hardware developments are examined. V L

A83-22590

STIMULUS VARIABLES AFFECTING DYNAMIC TARGET ACQUISITION

L. R. BEIDEMAN and F. E. GOMER (McDonnell Douglas Astronautics Co., Engineering Psychology Dept., St. Louis, MO) In: Airborne reconnaissance V; Proceedings of the Seminar, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1981, p. 141-146. (Contract F49620-77-C-0100)

Experiments were conducted using image dynamics which simulated a ground-stabilized narrow FOV sensor to examine the effects of IR 'Hot Spots' on target acquisition performance. Subjects were required to detect and recognize vehicle targets situated in backgrounds that varied in complexity. Displayed target signatures were representative of those associated with FLIR or TV imagery. Several performance and stimulus imagery measurements were recorded and preliminary regression analyses were performed on the results. Luminance distributions within the vehicle target and the background were important cues for both detection and recognition. (Author)

A83-22841* Honeywell, Inc., Lexington, Mass.

THERMAL INFRARED PUSHBROOM IMAGERY ACQUISITION AND PROCESSING

T. J. BROWN, F. J. CORBETT, T. J. SPERA, and T. ANDRADA (Honeywell, Inc., Defense Electronics Div., Lexington, MA) In: Modern utilization of infrared technology VII; Proceedings of the Seventh Annual Seminar, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 37-56. refs (Contract NAS5-24323; NAS5-25662)

A 9-element focal plane detector array and signal processing electronics was developed and delivered in December 1977. It was integrated into a thermal infrared imaging system using LSI microprocessor image processing and CRT display. After three years of laboratory operation, the focal plane has demonstrated high reliability and performance. On the basis of the 9-channel breadboard, the 90-element Aircraft Pushbroom IR/CCD Focal Plane Development Program was funded in October 1977. A follow-on program was awarded in July 1979, for the construction of a field test instrument and image processing facility. The objective of this project was to demonstrate thermal infrared pushbroom hard-copy imagery. It is pointed out that the successful development of the 9-element and 90-element thermal infrared hybrid imaging systems using photoconductive (Hg,Cd)Te has verified the operational concept of 8 to 14 micrometer pushbroom scanners. G.R.

A83-22882

SPATIAL CALIBRATION OF A MULTISPECTRAL DATA BASE
M. BAIR, D. CARMER, and J. BEARD (Michigan, Environmental Research Institute, Ann Arbor, MI) In: Contemporary infrared standards and calibration; Proceedings of the Meeting, San Diego, CA, August 25, 26, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 65-78. (Contract F33615-76-C-1360, DARPA ORDER 03293)

A new airborne multispectral scanner system has been developed for collecting image data to support high-accuracy autonomous terminal homing of advanced strategic delivery vehicles. The calibration aspects of this data base are examined, with emphasis placed on the geometrical reconstruction of the data. It is shown that the radiometric and geometric calibration of the imagery is made possible by the use of: (1) surveyed markers (benchmarks) in the scene imaged by both the metric camera and the laser ranging scanner; (2) the tape-recorded signals from the inertial navigation sensor; (3) known reflectance and temperatures from areas in the scene, (4) synchronization of all data flow and recording via a digital record interface system; and (5) specialized data processing. V.L.

N83-16338*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

RESULTS FROM TESTS, WITH VAN-MOUNTED SENSOR, OF MAGNETIC LEADER CABLE FOR AIRCRAFT GUIDANCE DURING ROLL-OUT AND TURNOFF

J. C. YOUNG, W. T. BUNDICK, and S. H. IRWIN Jan. 1983 38 p refs (NASA-TP-2092; L-15482; NAS 1.60.2092) Avail: NTIS HC A03/MF A01 CSCL 01D

Tests were conducted with a van mounted experimental magnetic leader cable sensor to evaluate its potential for measuring aircraft displacement and heading with respect to the leader cable during roll out and turnoff. Test results show that the system may be usable in measuring displacement but the heading measurement contains errors introduced by distortion of the magnetic field by the metal van or aircraft. Author

N83-16339# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.

THE ON-BOARD COMPUTER SYSTEM FOR THE F29 PROTOTYPE FLIGHT TEST

P. J. MANDERS 13 May 1981 45 p Presented at 4th Ann. Users Group Conf., San Diego, Calif., 22-25 Feb. 1981 and at the 4th AGARD Special Course on Flight Test Instrumentation Delft, Netherlands, May 1981 (NLR-MP-81034-U) Avail: NTIS HC A03/MF A01

The on board computer system of the Fokker F29 flight test instrumentation system is described. The central unit is a ROLM 1664 computer, with an interface unit to handle data word identification labeling, time tagging and selection. Visual display is available for system checkout and in flight quick look. Computer compatible tape is used for recording and post flight quick look. About 1800 parameters, at 10,000 samples/sec are recorded. In spite of the advantages in real-time behavior, and in less software complexity, a multiple computer configuration (with completely separated presentation and recording processes) was not preferred, because of the cost and the extra effort in computer-to-computer data transfer. Author (ESA)

N83-16340# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

THE F29 FLIGHT TEST INSTRUMENTATION AND DATA PROCESSING SYSTEM. AN OVERVIEW OF REQUIREMENTS, DESIGN AND ORGANIZATION

R. KRIJN 18 May 1981 36 p refs Presented at 4th AGARD Special Course on Flight Test Instrumentation, Delft, Netherlands, May 1981 (NLR-MP-81035-U) Avail: NTIS HC A03/MF A01

The process of designing a flight test instrumentation system is described and the F-29 system is presented. Technical and operational requirements are outlined and the organization of the

development phase is discussed. Reasons for selecting given measurement systems, e.g., digital or analog, on board or ground based, are explained.

Author (ESA)

N83-17466# Lufthansa German Airlines, Cologne (West Germany).

SLIDESLIP INDICATION SYSTEM

D. HORST /in DOE Symp. on Com. Aviation Energy Conserv. Strategies p 209-230 Apr. 1981 Previously announced as N82-25181

Avail: NTIS HC A17/MF A01 CSCL 01B

The development of a sideslip indication system for aircraft fuel conservation is outlined. A stall warning vane type sensor and an indicator in the cockpit were employed to detect horizontal gust activity. The teledyne stall warning transmitter can be used as a sideslip sensor. The following parameters are computed: sideslip angle, indicated air speed, magnetic heading, altitude, rudder position, elevator position, roll angle, and slat position.

E.A.K.

N83-17534*# Ohio Univ., Athens. Avionics Engineering Center. **COCKPIT WEATHER RADAR DISPLAY DEMONSTRATOR AND GROUND-TO-AIR SFERICS TELEMETRY SYSTEM Final Report, Dec. 1981 - Dec. 1982**

J. D. NICKUM and D. L. MCCALL 1982 81 p refs

(Contract NAG1-124)

(NASA-CR-169830; NAS 1.26:169830; OU/AEC-EER-53-5)

Avail: NTIS HC A05/MF A01 CSCL 01D

The results of two methods of obtaining timely and accurate severe weather presentations in the cockpit are detailed. The first method described is a course up display of uplinked weather radar data. This involves the construction of a demonstrator that will show the feasibility of producing a course up display in the cockpit of the NASA simulator at Langley. A set of software algorithms was designed that could easily be implemented, along with data tapes generated to provide the cockpit simulation. The second method described involves the uplinking of sfenc data from a ground based 3M-Ryan Stormscope. The technique involves transfer of the data on the CRT of the Stormscope to a remote CRT. This sfenc uplink and display could also be included in an implementation on the NASA cockpit simulator, allowing evaluation of pilot responses based on real Stormscope data.

Author

N83-17535*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

PLANNING FUEL-CONSERVATIVE DESCENTS WITH OR WITHOUT TIME CONSTRAINTS USING A SMALL PROGRAMMABLE CALCULATOR: ALGORITHM DEVELOPMENT AND FLIGHT TEST RESULTS

C. E. KNOX Mar. 1983 39 p refs

(NASA-TP-2085; L-15389; NAS 1.60:2085) Avail. NTIS HC

A03/MF A01 CSCL 01D

A simplified flight-management descent algorithm, programmed on a small programmable calculator, was developed and flight tested. It was designed to aid the pilot in planning and executing a fuel-conservative descent to arrive at a metering fix at a time designated by the air traffic control system. The algorithm may also be used for planning fuel-conservative descents when time is not a consideration. The descent path was calculated for a constant Mach/airspeed schedule from linear approximations of airplane performance with considerations given for gross weight, wind, and nonstandard temperature effects. The flight-management descent algorithm is described. The results of flight tests flown with a T-39A (Sabreliner) airplane are presented.

Author

AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

A83-19666

IMPROVED FAULT DETECTION IN THE HOT SECTION OF TURBOJET ENGINES BY INDIVIDUAL MONITORING PROCEDURES [VERBESSERTE SCHADENSERKENNUNG IM HEISSTEIL VON TURBOSTRAHLTRIEBWERKEN DURCH INDIVIDUELLE UEBERWACHUNGSVERFAHREN]

H. TOENSKOETTER (Industrieanlagen-Betriebsgesellschaft mbH, Ottobrunn, West Germany) and K.-H. KURZ (Aachen, Rheinisch-Westfaelische Technische Hochschule, Aachen, West Germany) Zeitschrift fuer Flugwissenschaften und Weltraumforschung, vol. 6, Nov.-Dec. 1982, p. 419-432. In German. Research supported by the Deutsche Forschungsgemeinschaft. refs

The effects of disturbances and damage in the internal throughflow components of turbojet engines on the behavior of the engines was experimentally studied by simulations of internal and external disturbances. The types of disturbances examined included inflow irregularities, compressor air discharge, compressor contamination, combustion chamber disturbances, and damage to the guide and runner blades. The local and average temperatures and pressures in the individual components were measured and, after a brief summary of the most important measurement results and a comparison with calculated parameter changes, the detectability of the studied disturbances using conventional aerothermodynamic monitoring procedures on the ground and in flight is discussed. Individual fault-specific diagnostic procedures are discussed in regard to improved fault detection in the hot section.

C.D.

A83-21079*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF BROAD PROPERTIES FUEL ON INJECTOR PERFORMANCE IN A REVERSE FLOW COMBUSTOR

S. M. RIDDLEBAUGH and C. T. NORGBURN (NASA, Lewis Research Center, Cleveland, OH) American Institute of Aeronautics and Astronautics, Aerospace Sciences Meeting, 21st, Reno, NV, Jan. 10-13, 1983, 15 p. refs

(AIAA PAPER 83-0154)

(Previously announced in STAR as N83-13101)

A83-21350

CLEANING GAS TURBINE COMPRESSORS - SOME SERVICE EXPERIENCE WITH A WET-WASH SYSTEM

D. BRITTAIN (Ivar Rivenaes, Ltd., London, England) Aircraft Engineering, vol. 55, Jan. 1983, p. 15-17.

It is pointed out that atmospheric contamination is the largest single cause of turbine compressor fouling. Liquid washing is considered preferable to grit blasting. With liquid washing, a fluid, which must be nonflammable, is sprayed into the air intake while the engine is running or being motored over. Since the fluid can pass through the engine safely, little if any preparation is necessary. In contrast to grit blasting, liquid washing does not pose a danger to the protective surface coatings. It is pointed out that in addition to cleaning the compressor, the fluid, by acting on other parts of the engine, can lengthen the time between overhauls. The simplicity of the procedure has been found to encourage frequent application to maintain engine performance. Another advantage is that the procedure does not require highly skilled technicians.

C.R.

A83-22154#

SETTING DESIGN GOALS FOR ADVANCED PROPULSION SYSTEMS

T. WARWICK (United Technologies Corp., West Palm Beach, FL) Journal of Aircraft, vol. 20, Mar. 1983, p. 203-207. refs (Contract N00019-80-C-0225) (AIAA PAPER 81-1505)

Significant reduction in the life cycle cost (LCC) of advanced weapon systems can be achieved without sacrificing combat capability by setting design goals for propulsion system 'ilities' that are balanced with the traditionally emphasized performance goals. This design philosophy was evaluated as an integral objective of the Advanced Technology Engine Studies (ATES) program under joint U.S. Navy/Air Force cognizance. This paper documents the methodology and results of ATES program conceptual design studies that set balanced cost-effective propulsion system design goals for durability, reliability, maintainability, and operability for several advanced aircraft weapon systems. (Author)

A83-22156#

INTERNAL PERFORMANCE PREDICTION FOR ADVANCED EXHAUST SYSTEMS

D. W. SPEIR and J. T. BLOZY (General Electric Co., Aircraft Engine Business Group, Evendale, OH) Journal of Aircraft, vol. 20, Mar. 1983, p. 216-221.

(Previously cited in issue 19, p. 3267, Accession no. A81-40908)

A83-22159#

HIGH BYPASS RATIO ENGINE NOISE COMPONENT SEPARATION BY COHERENCE TECHNIQUE

B. N. SHIVASHANKARA (Boeing Commercial Airplane Co., Seattle, WA) Journal of Aircraft, vol. 20, Mar. 1983, p. 236-242. refs

(Previously cited in issue 24, p. 4129, Accession no. A81-48653)

A83-22494* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FIBER OPTICS FOR AIRCRAFT ENGINE/INLET CONTROL

R. J. BAUMBICK (NASA, Lewis Research Center, Cleveland, OH) In: Fiber optics in adverse environments; Proceedings of the Seminar, San Diego, CA, August 25-27, 1981 Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 148-154. refs

(Previously announced in STAR as N81-31190)

A83-22651

THEORY AND DESIGN OF FLIGHT-VEHICLE ENGINES [TEORIYA I KONSTRUKTSIYA DVIGATELEI LETATEL'NYKH APPARATOV]

V. T. ZHDANOV, (ED.) and R. I. KURZINER Moscow, Akademiia Nauk SSSR, 1979. 158 p. In Russian.

Papers are presented on such topics as the testing of aircraft engines, errors in the experimental determination of the parameters of scramjet engines, the effect of the nonuniformity of supersonic flow with shocks on friction and heat transfer in the channel of a hypersonic ramjet engine, and the selection of the basic parameters of cooled GTE turbines. Consideration is also given to the choice of optimal total wedge angle for the air intake of a hypersonic ramjet engine, the use of jet engines for the acceleration of aerospace vehicles, the theory of an electromagnetic-resonator engine, the dynamic characteristics of the pumps and turbines of liquid propellant rocket engines in transition regimes, and a hierarchy of mathematical models for spacecraft control engines. B.J.

A83-22652

CURRENT PROBLEMS IN THE TESTING OF AIRCRAFT ENGINES [SOVREMENNYE PROBLEMY ISPYTANII AVIATSIONNYKH DVIGATELEI]

V. M. AKIMOV In: Theory and design of flight-vehicle engines Moscow, Akademiia Nauk SSSR, 1979, p. 5-29. In Russian.

The factors which determine current requirements on the testing of gas turbine engines are discussed, including the increasing structural and parametric complexity, the increasing complexity of operational conditions, the need for high reliability, the need for long service life, and the need to limit pollution of the environment. Specific aspects of engine testing are then considered, with attention given to noncontact measurements, experimental design, computer-aided testing and the use of mathematical models of the engines, and the simulation of flight conditions. Also considered are equivalent and cyclic tests, special tests relating to operational reliability, and tests relating to noise and the emission of toxic substances. B.J.

A83-22653

ERRORS IN THE EXPERIMENTAL DETERMINATION OF THE PARAMETERS OF SUPERSONIC COMBUSTION RAMJET ENGINES [O POGRESHNOSTIAKH EKSPERIMENTAL'NOGO OPREDELENIYA PARAMETROV VYSOKOSKOROSTNYKH PVRD]

IU. M. SHIKHMAN, M. V. STROKIN, and V. A. UVAROV In: Theory and design of flight-vehicle engines. Moscow, Akademiia Nauk SSSR, 1979, p. 30-42. In Russian. refs

The problem of investigating errors in the experimental determination of the parameters of scramjet engines, operating at Mach numbers of 4-6 is examined. It is shown that pressure measurement errors in the flow and on the walls of the flow channel have a significant effect on errors associated with working-process parameters and engine characteristics. The inaccuracy of Mach-number determination is shown to have a determining effect on the magnitude of the aforementioned errors. It is also shown that pressure measurements with an absolute rms error of not greater than 0.02 assure an acceptable accuracy of the determination of engine parameters and characteristics. B.J.

A83-22654

THE EFFECT OF THE NONUNIFORMITY OF SUPERSONIC FLOW WITH SHOCKS ON FRICTION AND HEAT TRANSFER IN THE CHANNEL OF A HYPERSONIC RAMJET ENGINE [O VLIYANII NERAVNOMERNOSTI SVERKHZVUKOVOGO TECHENIYA SO SKACHKAMI UPLOTNENIYA NA TRENIE I TEPLOBMEN V KANALE GPVRD]

O. V. VOLOSHCHENKO, V. N. OSTRAS, and V. A. EISMONT In: Theory and design of flight-vehicle engines. Moscow, Akademiia Nauk SSSR, 1979, p. 43-55. In Russian. refs

It is shown that, for a length/height ratio greater than or equal to 4, the calculation of total heat fluxes and friction force in the channel of a hypersonic ramjet engine can be performed assuming one-dimensional flow in the channel and using specified methods for calculating the boundary layer. This approach yields satisfactory results for axisymmetric flows as well as for two-dimensional asymmetric flows. Local specific heat fluxes must be determined on the basis of local flow parameters for the reason that their level can be three to four times greater than the level of specific heat fluxes calculated on the basis of uniform-flow parameters. B.J.

A83-22655

FEATURES OF THE SELECTION OF THE BASIC PARAMETERS OF COOLED GTE TURBINES [OSOBNOSTI VYBORA OSNOVNYKH PARAMETROV OKHLAZHDAEMYKH TURBIN GTD]

O. N. EMIN In: Theory and design of flight-vehicle engines. Moscow, Akademiia Nauk SSSR, 1979, p. 56-69. In Russian. refs

The effect of rotational velocity on the efficiency of a cooled single-stage turbine is investigated in the framework of a

one-dimensional and simple quasi-two-dimensional model of the working process, i.e., in the framework of calculations with respect to mean diameter. It is shown that, in contrast to the case of an uncooled turbine, the main factors which affect the internal efficiency of a cooled turbine are the load factor and the quantity of cooled air blown onto the blade surface. The highest values of efficiency of a cooled turbine are obtained for regimes in the case of which the value of the load factor is higher than that recommended for uncooled turbines. The dependence of efficiency on rotational velocity is found to have an extremal character.

B.J.

A83-22656

ON THE CHOICE OF THE OPTIMAL TOTAL WEDGE ANGLE FOR THE AIR INTAKE OF A HYPERSONIC RAMJET ENGINE [K VOPROSU O VYBORE OPTIMAL'NOGO SUMMARNOGO UGLA KLINA VOZDUKHOZABOMIKA GPVRD]

V. I. PENZIN In: Theory and design of flight-vehicle engines. Moscow, Akademiia Nauk SSSR, 1979, p. 70-80. In Russian.

Theoretical results are presented on the choice of the optimal total wedge angle for the air intake of a hypersonic ramjet engine. The optimal total wedge angle is investigated as a function of the excess fuel ratio (the stoichiometric equivalent), the number of shocks, the relative throat area, the form of the cowl, and other parameters for the Mach number range of 6-10.

B.J.

A83-22658

NUMERICAL CALCULATION OF THE SEPARATION AND CONNECTION OF TWO-DIMENSIONAL SUPERSONIC FLOWS IN CHANNELS WITH DISCONTINUOUS BOUNDARIES [CHISLENNYI RASCHET RAZDELENNIA I OB'EDINENIIA PLOSKIKH SVERKHZVUKOVYKH TECHENII V KANALAKH S RAZRYVNYMI GRANITSAMI]

A. T. BERLIAND and A. F. CHEVAGIN In: Theory and design of flight-vehicle engines. Moscow, Akademiia Nauk SSSR, 1979, p. 100-116. In Russian. refs

The paper describes a general-purpose program implementing a numerical method for calculating supersonic flows for regions with complex discontinuous boundaries, with particular reference to hypersonic ramjet engines. The numerical method considered is that of Berliand and Frost (1972) for calculating two-dimensional supersonic flows with automatic determination of discontinuities and stepwise approximation rarefaction flows. The efficiency of the program is demonstrated on a number of model examples.

B.J.

A83-23142

GAS TURBINE COMBUSTOR MODELLING FOR CALCULATING POLLUTANT EMISSION

G. ROMBERG (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer theoretische Stroemungsmechanik, Goettingen, West Germany) International Journal of Heat and Mass Transfer, vol. 26, Feb. 1983, p. 197-209. refs

In this paper two aspects of can and annular combustor primary zone flows are considered in detail. Firstly, pollutant production and transport in the primary zone are described by a three-dimensional mathematical model. Secondly, the mechanical and thermodynamic state of the flow at the primary zone exit is described by a one-dimensional mathematical model. The general system function of a connection in series of the two models provides the NO emission from the primary zone in terms of engine operating parameters such as fuel injection rate and water injection rate. The modeling method shows an important effect of the ratio of the cooling air inflow to the combustion air inflow on NO emission. Also, the influence of dissociation on the flow at the primary zone exit is analyzed.

(Author)

A83-23175

DESIGN OF AN INTEGRATED CONTROL SYSTEM FOR A SUPERSONIC AIRCRAFT POWER PLANT

N. MUNRO, D. E. WINTERBONE, and J. R. SEARS (University of Manchester Institute of Science and Technology, Manchester, England) In: Application of multivariable systems theory; Symposium, Plymouth, England, October 26-28, 1982, Collected Papers. London, Institute of Measurement and Control, 1982, p. 173-184. refs

A supersonic aircraft powerplant consisting of the engine, the air intake system, the reheat assembly, and the propelling nozzle are studied as an integrated system, and a control system is determined for this configuration. Suitable input variables and output measurements are defined and a locally linearised model in transfer-function matrix form is determined about a representative operating point, from a nonlinear hybrid simulation of the engine system. Using the resulting 3-input and 3-output model, a multivariable control scheme is designed using Rosenbrock's Inverse Nyquist Array method. The behavior of the closed-loop integrated control system obtained is compared with a traditionally designed multiple separate single control-loop scheme (Author)

A83-23239

PW 4000 - A RADICALLY NEW JET ENGINE BEING DEVELOPED IN THE USA

Aircraft Engineering, vol. 55, Feb. 1983, p. 2-5.

The design features and performance capabilities of the PW 4000-series turbofan for wide body airliners are presented, using as a point of reference the characteristics of the JT9D family of turbofans which the present state-of-the-art design will supplant after certification in 1986. Fuel consumption is expected to be reduced by 7%, and maintenance and repair will be significantly simplified by the use of 54% fewer parts. A unique feature of the PW 4000 is the 'Thermatic' high pressure compressor rotor, which under the appropriate conditions employs temperature increases to automatically expand and thereby tighten blade tip and seal clearances. Maximum rotor speed for the PW 4000 is 27% faster than in the JT9D, yielding greater efficiency. A completely digital engine control system is employed which can precisely manage thrust levels for maximum efficiency.

O.C.

N83-16341*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.

ENERGY EFFICIENT ENGINE: FAN TEST HARDWARE DETAILED DESIGN REPORT

T. J. SULLIVAN Oct. 1980 146 p refs

(Contract NAS3-20643)

(NASA-CR-165148; NAS 1.26:165148; R80-AEG-417) Avail:

NTIS HC A07/MF A01 CSCL 21E

A single stage fan and quarter stage booster were designed for the energy efficient engine. The fan has an inlet radius ratio of 0.342 and a specific flow rate of 208.9 Kg/S sq m (42.8 lbm/sec sq ft). The fan rotor has 32 medium aspect ratio (2.597) titanium blades with a partspan shroud at 55% blade height. The design corrected fan tip speed is 411.5 M/S (1350 ft/sec). The quarter stage island splits the total fan flow with approximately 22% of the flow being supercharged by the quarter stage rotor. The fan bypass ratio is 6.8. The core flow total pressure ratio is 1.67 and the fan bypass pressure ratio is 1.65. The design details of the fan and booster blading, and the fan frame and static structure for the fan configuration are presented.

S.L.

N83-16342*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Group.

THE CF6 ENGINE PERFORMANCE IMPROVEMENT Summary Report

W. A. FASCHING Oct. 1982 98 p refs

(Contract NAS3-20629)

(NASA-CR-165612; NAS 1.26:165612; R82AE511) Avail: NTIS

HC A05/MF A01 CSCL 21E

As part of the NASA-sponsored Engine Component Improvement (ECI) Program, a feasibility analysis of performance improvement and retention concepts for the CF6-6 and CF6-50

engines was conducted and seven concepts were identified for development and ground testing: new fan, new front mount, high pressure turbine aerodynamic performance improvement, high pressure turbine roundness, high pressure turbine active clearance control, low pressure turbine active clearance control, and short core exhaust nozzle. The development work and ground testing are summarized, and the major test results and an economic analysis for each concept are presented. Author

N83-16343* Garrett Turbine Engine Co., Phoenix, Ariz.
A METHOD TO ESTIMATE WEIGHT AND DIMENSIONS OF SMALL AIRCRAFT PROPULSION GAS TURBINE ENGINES: USER'S GUIDE Final Report
 P. L. HALE Aug. 1982 136 p refs
 (Contract NAS3-23037)
 (NASA-CR-168049; NAS 1.26:168049; GARRETT-21-4270-1.1)
 Avail: NTIS HC A07/MF A01 CSCL 21E

The weight and major envelope dimensions of small aircraft propulsion gas turbine engines are estimated. The computerized method, called WATE-S (Weight Analysis of Turbine Engines-Small) is a derivative of the WATE-2 computer code. WATE-S determines the weight of each major component in the engine including compressors, burners, turbines, heat exchangers, nozzles, propellers, and accessories. A preliminary design approach is used where the stress levels, maximum pressures and temperatures, material properties, geometry, stage loading, hub/tip radius ratio, and mechanical overspeed are used to determine the component weights and dimensions. The accuracy of the method is generally better than + or - 10 percent as verified by analysis of four small aircraft propulsion gas turbine engines. S.L.

N83-16345# Dayton Univ., Ohio. Research Inst.
ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF TURBINE BLADE DAMPING Final Report, 30 Jun. 1981 - 29 Jun. 1982
 R. J. DOMINIC, P. A. GRAF, and B. B. RAJU Aug. 1982 57 p refs
 (Contract F49620-81-K-0014; AF PROJ. 2307)
 (AD-A120470; UDR-TR-82-39; AFOSR-82-0911TR) Avail: NTIS HC A04/MF A01 CSCL 21E

Simulated blade to disk damping of a model turbine blade was evaluated, both experimentally and analytically. Experimental work was performed with a unique apparatus that introduced friction damping at the blade platform. Analytical work was performed with a computer program based on the lumped mass theoretical analysis developed by Muszynska and Jones. A test was performed also to evaluate the coefficient of friction at the test setup conditions. Experimental and analytical studies showed good qualitative agreement. Very high damping was achieved by means of friction. Blade response to forced vibration was reduced by two orders of magnitude over the frequency range of the first two bending modes of the blade at the optimum friction damping conditions. For the tested blade configuration, optimum damping occurred when the friction force (Micro N) was equal to or slightly greater than the excitation force. GRA

N83-16346# Neilsen Engineering and Research, Inc., Mountain View, Calif.
BLADE EROSION EFFECTS ON AIRCRAFT-ENGINE COMPRESSOR PERFORMANCE Final Report, 1 Sep. 1979 - 31 Mar. 1982
 R. G. SCHWIND and O. J. MCMILLAN Sep. 1982 56 p refs
 (Contract DE-AC03-79CS-50095)
 (DE82-021791; DOE/CS-50095/T2; NEAR-TR-274) Avail: NTIS HC A04/MF A01

Results are presented from a research program intended to allow prediction of changes in JT8D compressor performance due to blade shape changes caused by erosion. A review of pertinent literature is included in which the mechanisms responsible for turbine engine performance deterioration are discussed. Profile measurements of new blades for the JT8D-7 engine are given, and the level of variability among different samples of new blades established. To allow assessment of the areas in the compressor

where blade shape changes due to erosion are important in comparison to this new blade variability, measurements of corresponding sections of used blades were also made. The change in blade element performance associated with a particular shape change for one of these blade sections is calculated; the major effect predicted is a considerable loss of turning by the blade element. The means by which these results can be used to calculate changes in overall compressor performance are indicated. DOE

N83-16347# Limbach-Motorenbau, Koenigswinter (West Germany)
VIBRATION-FREE INTERNAL COMBUSTION ENGINE FOR GENERAL AVIATION Final Report, Nov. 1981
 P. LIMBACH, JR. Bonn Bundesministerium fuer Forschung und Technologie Aug. 1982 58 p In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie
 (BMFT-FB-W-82-016; ISSN-0170-1339) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 11,50

A working engine model was designed and built in order to demonstrate that engines based on the Huf principle are possible. Function, certain design features, and results of vibration measurements on the first Huf-engine built, the HL 2000, are outlined. During test runs reduction of the vibration level of up to 70% was observed, as compared to conventional piston engines. Without complicated technologies it is possible to build functional aircraft and other engines according to the Huf-principle, with excellent chances on the market. Author (ESA)

N83-17457# Neilsen Engineering and Research, Inc., Mountain View, Calif.
DEVELOPMENT OF A PROCEDURE FOR CALCULATING THE EFFECTS OF AIRFOIL EROSION ON AIRCRAFT ENGINE COMPRESSOR PERFORMANCE
 O. J. MCMILLAN In DOE Symp. on Com. Aviation Energy Conserv. Strategies p 31-44 Apr. 1981 refs
 (Contract DE-AC03-79CS-50095)
 Avail: NTIS HC A17/MF A01 CSCL 01B

Maximizing the fuel efficiency of the low-bypass turbofan, the JJ8D, through proper maintenance is addressed. Determining how much of an increase in fuel consumption is associated with a particular kind of JJ8D geometry change was considered. A procedure to allow the detailed assessment of the effects of fan or compressor airfoil erosion on JJ8D fuel consumption was developed. Author

N83-17467# Flow Application Research, Fremont, Calif.
TURBINE ENGINE FUEL CONSERVATION BY FAN AND COMPRESSOR PROFILE CONTROL
 W. B. ROBERTS and W. ROGERS (Rogers-Dierks, Inc.) In DOE Symp. on Com. Aviation Energy Conserv. Strategies p 231-258 Apr. 1981
 Avail: NTIS HC A17/MF A01 CSCL 01B

The control of the compressor blade shapes which can provide fuel savings was examined. The blade shapes become distorted due to erosion which causes an aerodynamic performance deterioration and increases fuel consumption. Refurbished and new blades are at fuel consumption to near new engine values. Reconditioned blades which are sorted, reshaped and matched allow a superior recovery of fuel efficiency without the need for new blades. New blades, upon being put into service, can greatly benefit from being sorted, reshaped, and matched to allow full performance potential to be realized. The first stage fan blade is most critical, since it operates in a high erosion environment at supercritical aerodynamic conditions, while consuming more power than any other single blade. It is shown that fan and compressor blade shape control can lower fuel burn as much as 2-2 1/2% compared to standard refurbishment which leads to a significant fuel savings if implemented on a fleet wide basis. It is suggested that all aviation gas turbine engines would benefit from fan and compressor blade profile control. E.A.K.

07 AIRCRAFT PROPULSION AND POWER

N83-17539*# General Electric Co., Evendale, Ohio. Aircraft Engine Business Group.

SUMMARY REPORT FOR CF6 JET ENGINE DIAGNOSTICS PROGRAM Final Report

W. A. FASCHING and R. STRICKLIN Oct. 1982 44 p refs
(Contract NAG3-20631)

(NASA-CR-165582; NAS 1.26:165582; R81-AEG-654) Avail:

NTIS HC A03/MF A01 CSCL 01E

Cockpit cruise recordings and test cell data in conjunction with hardware inspection results from airline overhaul shops were analyzed to define the extent and magnitude of performance deterioration of the General Electric CF6 high bypass turbofan engines. The magnitude of Short Term deterioration from the Long Term was isolated and the individual damage mechanisms that were the cause for the majority of the performance deterioration were identified. A potential for reduction in compressor clearance and a potential for improvement in turbine roundness, which corresponds to cruise SFC reductions of 0.38 and 0.36 percent, respectively, were identified. Author

N83-17542*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.

EQUIVALENT DAMAGE: A CRITICAL ASSESSMENT Final Report, Aug. 1980 - Dec. 1981

J. R. LAFLEN and T. S. COOK Nov. 1982 203 p refs

(NASA-CR-167874; NAS 1.26:167874; R82AEG533) Avail:

NTIS HC A10/MF A01 CSCL 21E

Concepts in equivalent damage were evaluated to determine their applicability to the life prediction of hot path components of aircraft gas turbine engines. Equivalent damage was defined as being those effects which influence the crack initiation life-time beyond the damage that is measured in uniaxial, fully-reversed sinusoidal and isothermal experiments at low homologous temperatures. Three areas of equivalent damage were examined: mean stress, cumulative damage, and multiaxiality. For each area, a literature survey was conducted to aid in selecting the most appropriate theories. Where possible, data correlations were also used in the evaluation process. A set of criteria was developed for ranking the theories in each equivalent damage regime. These criteria considered aspects of engine utilization as well as the theoretical basis and correlative ability of each theory. In addition, consideration was given to the complex nature of the loading cycle at fatigue critical locations of hot path components; this loading includes non-proportional multiaxial stressing, combined temperature and strain fluctuations, and general creep-fatigue interactions. Through applications of selected equivalent damage theories to some suitable data sets it was found that there is insufficient data to allow specific recommendations of preferred theories for general applications. A series of experiments and areas of further investigations were identified. Author

N83-17543*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.

THE JT8D AND JT9D ENGINE COMPONENT IMPROVEMENT: PERFORMANCE IMPROVEMENT PROGRAM Executive Summary Report

W. O. GAFFIN May 1982 32 p refs

(Contract NAS3-20630)

(NASA-CR-167965; NAS 1.26:167965; PWA-5515-177) Avail:

NTIS HC A03/MF A01 CSCL 21E

The NASA sponsored Engine Component Improvement - Performance Improvement Program at Pratt & Whitney Aircraft advanced the state of the art of thermal barrier coatings and ceramic seal systems, demonstrated the practicality of an advanced turbine clearance control system and an advanced fan design in the JT9D engine, and demonstrated the advantages of modern cooling, sealing, and aerodynamic designs in the high pressure turbine and compressor of the JT8D engine. Several of these improvements are already in airline service in JT8D and JT9D engines, and others will enter service soon in advanced models of these engines. In addition, the technology advances are being transferred to completely new engine configurations, the PW2037

engine and the NASA sponsored Energy Efficient Engine.

Author

N83-17544*# Pratt and Whitney Aircraft Group, East Hartford, Conn. Commercial Products Div.

THE JT9D JET ENGINE DIAGNOSTICS PROGRAM Executive Summary Report

W. J. OLSSON May 1982 26 p refs

(Contract NAS3-20632)

(NASA-CR-167966; NAS 1.26:167966; PWA-5512-96) Avail:

NTIS HC A03/MF A01 CSCL 21E

The various engine deterioration phenomena that affect JT9D performance retention were studied, and approaches to improve performance retention of engines were identified. The program included surveys of historical data, monitoring of in service engines, ground and flight testing of instrumented engines, analysis, and analytical modeling. Performance deterioration is made up of both short and long term modes, both of which are flight cycle related phenomena. Short term deterioration occurs primarily during airplane acceptance testing prior to delivery to the airline. This effect is caused by flight load and power induced clearance closures and engine deflections with resulting rubbing of airfoils and seals. Long term deterioration is caused by erosion of airfoils and gas path seals during ground operation and take off and by cyclic induced thermal distortion of the high pressure turbine airfoils. Studies of possible remedial approaches have shown that performance retention within 1 to 2 percent of initial revenue service performance can be achieved with a proper program of hot section and cold section maintenance. S.L.

N83-17545*# Curtiss-Wright Corp., Wood-Ridge, N.J.

STUDY OF ADVANCED ROTARY COMBUSTION ENGINES FOR COMMUTER AIRCRAFT Final Report

M. BERKOWITZ, C. JONES, and D. MYERS Feb. 1983 58 p refs

(Contract NAS3-22140)

(NASA-CR-165399; NAS 1.26:165399; CW-WR-81-022F) Avail:

NTIS HC A04/MF A01 CSCL 21E

Performance, weight, size, and maintenance data for advanced rotary aircraft engines suitable for comparative commuter aircraft system evaluation studies of alternate engine candidates are provided. These are turbocharged, turbocompounded, direct injected, stratified charge rotary engines. Hypothetical engines were defined (an RC4-74 at 895 kW and an RC6-87 at 1490 kW) based on the technologies and design approaches used in the highly advanced engine of a study of advanced general aviation rotary engines. The data covers the size range of shaft power from 597 kW (800 hp) to 1865 kW (2500 hp) and is in the form of drawings, tables, curves and written text. These include data on internal geometry and configuration, installation information, turbocharging and turbocompounding arrangements, design features and technologies, engine cooling, fuels, scaling for weight size BSFC and heat rejection for varying horsepower, engine operating and performance data, and TBO and maintenance requirements. The basic combustion system was developed and demonstrated; however the projected power densities and performance efficiencies require increases in engine internal pressures, thermal loading, and rotative speed. S.L.

N83-17546*# Pratt and Whitney Aircraft Group, West Palm Beach, Fla. Government Products Div.

FLIGHT EVALUATION OF AN ENGINE STATIC PRESSURE NOSEPROBE IN AN F-15 AIRPLANE Final Report

C. H. FOOTE and R. F. JAEKEL 15 Aug. 1981 21 p

(Contract NAS4-2703)

(NASA-CR-163109; NAS 1.26:163109; FR-14915) Avail: NTIS

HC A02/MF A01 CSCL 21E

The flight testing of an inlet static pressure probe and instrumented inlet case produced results consistent with sea-level and altitude stand testing. The F-15 flight test verified the basic relationship of total to static pressure ratio versus corrected airflow and automatic distortion downmatch with the engine pressure ratio control mode. Additionally, the backup control inlet case statics

demonstrated sufficient accuracy for backup control fuel flow scheduling, and the station 6 manifolded production probe was in agreement with the flight test station 6 total pressure probes.

Author

N83-17547* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AERODYNAMIC EFFECT OF A HONEYCOMB ROTOR TIP SHROUD ON A 50.8-CENTIMETER-TIP-DIAMETER CORE TURBINE

T. P. MOFFITT and W. J. WHITNEY Jan. 1983 19 p refs (NASA-TP-2112; E-1261; NAS 1.60:2112) Avail: NTIS HC A02/MF A01 CSCL 21E

A 50.8-cm-tip-diameter turbine equipped with a rotor tip shroud of hexagonal cell (or honeycomb) cross section has been tested in warm air (416 K) for a range of shroud coolant to primary flow rates. Test results were also obtained for the same turbine operated with a solid shroud for comparison. The results showed that the combined effect of the honeycomb shroud and the coolant flow was to cause a reduction of 2.8 points in efficiency at design speed, pressure ratio, and coolant flow rate. With the coolant system inactivated, the honeycomb shroud caused a decrease in efficiency of 2.3 points. These results and those obtained from a small reference turbine indicate that the dominant factor governing honeycomb tip shroud loss is the ratio of honeycomb depth to blade span. The loss results of the two shrouds could be correlated on this basis. The same honeycomb and coolant effects are expected to occur for the hot (2200 K) version of this turbine

Author

N83-17549# Naval Postgraduate School, Monterey, Calif.

AN INVESTIGATION OF THE EFFECTIVENESS OF SMOKE SUPPRESSANT FUEL ADDITIVES FOR TURBOJET APPLICATIONS Final Report

J. R. BRAMER and D. W. NETZER Sep. 1982 71 p refs (AD-A121228; NPS67-82-13) Avail: NTIS HC A04/MF A01 CSCL 21E

Seven fuel additives were tested to investigate their effectiveness at reducing exhaust stack gas opacity in a turbojet test cell. Exhaust particle sizes and mass concentrations were determined at the engine and stack exhausts using measurements of light transmittance at three frequencies. Particle samples were also collected at the engine exhaust and measured with a scanning electron microscope to verify the optical technique. Nitrous oxide emissions were measured at the test cell stack exhaust. Four of the additives tested were found effective at reducing stack exhaust opacity and particulate mass concentration. None of the additives had any measurable effect on particle diameters. No meaningful changes in particle size or mass occurred between the engine and stack exhausts. The optical technique for determining particle size was verified effective using the scanning electron microscope. No additive had any significant effect on nitrous oxide production.

Author (GRA)

08

AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities, piloting; flight controls; and autopilots.

A83-20074

F-104 CCV RESEARCH FLIGHT TEST PROGRAM

N. MEISTER (Messerschmitt-Boelkow-Blohm GmbH, Ottobrunn, West Germany) (Society of Experimental Test Pilots, European Symposium, Linköping, Sweden, June 17-19, 1982.) Cockpit, vol. 17, Oct.-Dec. 1982, p. 5-19.

System features and flight handling characteristics of the F-104 CCV test vehicle after being equipped with a redundant, quadruplex, digital fly-by-wire computing system are detailed. The mechanical

control system was maintained active for the event of an emergency mode. A semi-automatic feature synchronizes the standby mechanical system to the actual fly-by-wire surface position. The fly-by-wire control laws are examined, and deficiencies observed in the flare behavior, small amplitude pitch response, and the pitch trim response are discussed. Further developments are required for fast stabilization, a reduction of stick forces without rate interference for maneuvering, producing a trim rate to compensate maximum level accelerations or decelerations with intermittent trim clicking, and neutralization of the stick forces for IFR procedure turns.

M.S.K.

A83-20144

INVESTIGATION OF THE LONGITUDINAL MOTION OF A FLIGHT VEHICLE BY THE METHOD OF THE SEPARATION OF MOTIONS [ISSLEDOVANIIE PRODOL'NOGO DVIZHENIIA LETATEL'NOGO APPARATA METODOM RAZDELENIIA DVIZHENII]

V. I. BORZOV Moskovskii Universitet, Vestnik, Seria 1 - Matematika, Mekhanika, Nov.-Dec. 1982, p. 91-95. In Russian.

The motion-separation method is used to study the motion of a flight vehicle in the vertical plane. Based on the transition to slow dimensionless time and the normalization of variables, the initial system is transformed into a system of differential equations with singular perturbations. The possibility of the synthesis of control for both rapid and slow motions is shown for the case of flight at constant height.

B.J.

A83-21002* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

AUTOMATION OF ON-BOARD FLIGHTPATH MANAGEMENT

H. ERZBERGER (NASA, Ames Research Center, Moffett Field, CA) In: Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers. Haifa, Technion - Israel Institute of Technology, 1982, p. 1-19. refs

(Previously announced in STAR as N82-16088)

A83-21006#

CONSTRAINED EIGENVALUE/EIGENVECTOR ASSIGNMENT - APPLICATION TO FLIGHT CONTROL SYSTEMS

E. Y. SHAPIRO and J. C. CHUNG (Lockheed-California Co., Burbank, CA) In: Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers. Haifa, Technion - Israel Institute of Technology, 1982, p. 37-43. refs

The present investigation is concerned with the establishment of an efficient practical synthesis procedure for modern flight control systems. The proposed procedure is based on the computation of a constant output feedback gain matrix of a prespecified structure. Some of the closed loop eigenvalues are assigned to prescribed locations, and the respective closed loop eigenvectors are aligned with prespecified directions which reflect the desired mode distribution in the system. Attention is given to aspects of problem formulation, the feedback gain calculation, eigenvector approximation, and a numerical example. This example is concerned with the Stability Augmentation System design for the lateral axis, rigid body model of the L-1011 aircraft at cruise flight condition.

G.R.

A83-21160

APPLICATION OF VECTOR PERFORMANCE OPTIMIZATION TO A ROBUST CONTROL LOOP DESIGN FOR A FIGHTER AIRCRAFT

G. KREISSELMEIER and R. STEINHAUSER (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Dynamik der Flugsysteme, Oberpfaffenhofen, West Germany) International Journal of Control, vol. 37, Feb. 1983, p. 251-284. refs

For a McDonnell-Douglas F-4C aircraft a robust, fixed gain controller is designed, which provides satisfying handling qualities of the longitudinal motion of the aircraft over the complete flight range without gain scheduling. Robustness is achieved in the sense

of covering large parameter variations and providing good gain and phase margins. Only low control rates and low feedback gains are involved. The results are obtained by application of a performance vector optimization design method which accounts for a great many different design objectives simultaneously in a highly systematic fashion. Two different designs are presented placing emphasis on pitch rate control (pointing) and normal acceleration control (manoeuvring) respectively. (Author)

A83-22076

AIRCRAFT MANEUVER MECHANICS WITH TURNING OF THE POWER-PLANT THRUST VECTOR [MEKHANIKA MANEVRIROVANIIA SAMOLETOV S POBOROTOM VEKTORA TIAGI SILOVOI USTANOVKI]

I. F. OBRAZTSOV, V. F. PAVLENKO, and A. I. NELIUBOV (Voenno-Vozdushnaya Inzhenernaya Akademiya, Moscow, USSR) Akademiya Nauk SSSR, Doklady, vol. 267, no. 6, 1982, p. 1326-1330. In Russian.

The paper examines the possibility of improving the maneuverability of a VTOL aircraft by turning the thrust vector of the lift sustainer engine upward from the longitudinal axis of the aircraft by an angle greater than $\pi/2$. It is shown that this thrust-vector approach makes possible a significant improvement in the braking and dive characteristics of the aircraft as well as a reduction in the area required for the maneuver. Separate control of angle of attack, pitching, and trajectory can be achieved by increasing the mass of the power plant and, in some cases, by increasing the fuel consumption for the maneuver. In addition, this approach can improve the takeoff and landing characteristics of VTOL aircraft. B.J.

A83-22160*# Goodyear Aerospace Corp., Akron, Ohio.

DYNAMIC STABILITY OF A BUOYANT QUAD-ROTOR AIRCRAFT

B. L. NAGABHUSHAN (Goodyear Aerospace Corp., Defense Systems Div., Akron, OH) Journal of Aircraft, vol. 20, Mar. 1983, p. 243-249. refs (Contract NAS2-10777)

(Previously cited in issue 06, p. 814, Accession no. A82-17861)

A83-22164*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

FLIGHT TEST RESULTS OF AN ACTIVE FLUTTER SUPPRESSION SYSTEM

J. W. EDWARDS (NASA, Langley Research Center, Unsteady Aerodynamics Branch, Hampton, VA) (Structures, Structural Dynamics and Materials Conference, 22nd, Atlanta, GA, April 6-8, 1981, and AIAA Dynamics Specialists Conference, Atlanta, GA, April 9, 10, 1981, Technical Papers, Part 2, p. 778-789.) Journal of Aircraft, vol. 20, Mar. 1983, p. 267-274. refs

(Previously cited in issue 12, p. 1950, Accession no. A81-29507)

A83-23222#

IDENTIFICATION OF CERTAIN DYNAMIC CHARACTERISTICS OF A HELICOPTER-AUTOPILOT SYSTEM BY MEANS OF SIMULATION [IDENTYFIKACJA NIEKTORYCH CHARAKTERYSTYK DYNAMICZNYCH UKLADU 'SMIGLOWIEC-AUTOPILOT' METODA SYMULACJI]

P. TOMASZEWICZ Instytut Lotnictwa, Prace, no. 90, 1982, p. 17-39. In Polish. refs

Simulation results are presented on the dynamic behavior of an autopilot-controlled helicopter, the aim of the study being to determine the dependence of this behavior on the autopilot parameters. The simulation system consisted of an analog model of the helicopter dynamics and a set of elements of a real autopilot. The ability of the simulation system to satisfy certain criteria regarding the control characteristics of the helicopter is verified, and results are presented which show the positive effect of increased damping of the rotational motions of the helicopter due to the velocity feedback of the autopilot. B.J.

N83-16349*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

DYNAMIC STRUCTURAL AEROELASTIC STABILITY TESTING OF THE XV-15 TILT ROTOR RESEARCH AIRCRAFT

L. G. SCHROERS Dec. 1982 21 p refs Prepared in cooperation with Army Aviation Research and Development Command, Moffett Field, Calif.

(NASA-TM-84293; A-9081; NAS 1.15:84293;

USAAVRADCOM-82-A-17) Avail: NTIS HC A02/MF A01 CSCL 01C

For the past 20 years, a significant effort has been made to understand and predict the structural aeroelastic stability characteristics of the tilt rotor concept. Beginning with the rotor-pylon oscillation of the XV-3 aircraft, the problem was identified and then subjected to a series of theoretical studies, plus model and full-scale wind tunnel tests. From this data base, methods were developed to predict the structural aeroelastic stability characteristics of the XV-15 Tilt Rotor Research Aircraft. The predicted aeroelastic characteristics are examined in light of the major parameters effecting rotor-pylon-wing stability. Flight test techniques used to obtain XV-15 aeroelastic stability are described. Flight test results are summarized and compared to the predicted values. Wind tunnel results are compared to flight test results and correlated with predicted values. A.R.H.

N83-16350*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE APPLICATION OF PARAMETER ESTIMATION TO FLIGHT MEASUREMENTS TO OBTAIN LATERAL-DIRECTIONAL STABILITY DERIVATIVES OF AN AUGMENTED JET-FLAP STOL AIRPLANE

J. D. STEPHENSON Jan. 1983 62 p refs

(NASA-TP-2033; A-8977; NAS 1.60:2033) Avail: NTIS HC A04/MF A01 CSCL 01C

Flight experiments with an augmented jet flap STOL aircraft provided data from which the lateral directional stability and control derivatives were calculated by applying a linear regression parameter estimation procedure. The tests, which were conducted with the jet flaps set at a 65 deg deflection, covered a large range of angles of attack and engine power settings. The effect of changing the angle of the jet thrust vector was also investigated. Test results are compared with stability derivatives that had been predicted. The roll damping derived from the tests was significantly larger than had been predicted, whereas the other derivatives were generally in agreement with the predictions. Results obtained using a maximum likelihood estimation procedure are compared with those from the linear regression solutions. Author

N83-17550*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

ANALYSIS OF OSCILLATORY MOTION OF A LIGHT AIRPLANE AT HIGH VALUES OF LIFT COEFFICIENT

J. G. BATTERSON Feb. 1983 51 p refs

(NASA-TM-84563; L-15122; NAS 1.15:84563) Avail: NTIS HC A04/MF A01 CSCL 01C

A modified stepwise regression is applied to flight data from a light research air-plane operating at high angles at attack. The well-known phenomenon referred to as buckling or porpoising is analyzed and modeled using both power series and spline expansions of the aerodynamic force and moment coefficients associated with the longitudinal equations of motion. Author

N83-17551*# Douglas Aircraft Co., Inc., Long Beach, Calif.

EVALUATION OF LAMINAR FLOW CONTROL SYSTEMS FOR SUBSONIC COMMERCIAL TRANSPORT AIRCRAFT: EXECUTIVE SUMMARY

W. E. PEARCE Dec. 1982 72 p refs

(Contract NAS1-14632)

(NASA-CR-159252; NAS 1.26:159252; ACEE-01-FR-2995) Avail: NTIS HC A04/MF A01 CSCL 01C

An evaluation was made of laminar flow control (LFC) system concepts for subsonic commercial transport aircraft. Configuration design studies, performance analyses, fabrication development,

structural testing, wind tunnel testing, and contamination-avoidance techniques were included. As a result of trade studies, a configuration with LFC on the upper wing surface only, utilizing an electron beam-perforated suction surface, and employing a retractable high-lift shield for contamination avoidance, was selected as the most practical LFC system. The LFC aircraft was then compared with an advanced turbulent aircraft designed for the same mission. This comparison indicated significant fuel savings.

Author

N83-17552* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

MINIMUM-FUEL TURNING CLIMBOUT AND DESCENT GUIDANCE OF TRANSPORT JETS

F. NEUMAN and E. KREINDLER (Technion - Israel Inst of Tech.) Jan. 1983 46 p refs

(NASA-TM-84289; A-9067; NAS 1.15.84289) Avail: NTIS HC A03/MF A01 CSCL 01C

The complete flightpath optimization problem for minimum fuel consumption from takeoff to landing including the initial and final turns from and to the runway heading is solved. However, only the initial and final segments which contain the turns are treated, since the straight-line climbout, cruise, and descent problems have already been solved. The paths are derived by generating fields of extremals, using the necessary conditions of optimal control together with singular arcs and state constraints. Results show that the speed profiles for straight flight and turning flight are essentially identical except for the final horizontal accelerating or decelerating turns. The optimal turns require no abrupt maneuvers, and an approximation of the optimal turns could be easily integrated with present straight-line climb-cruise-descent fuel-optimization algorithms. Climbout at the optimal IAS rather than the 250-knot terminal-area speed limit would save 36 lb of fuel for the 727-100 aircraft.

Author

N83-17553* Textron Bell Helicopter, Fort Worth, Tex. **BENEFITS ASSESSMENT OF ACTIVE CONTROL TECHNOLOGY AND RELATED COCKPIT TECHNOLOGY FOR ROTORCRAFT**

B. J. HAMPTON 23 Aug. 1982 141 p refs
(NASA-CR-166406; NAS 1.26:166406) Avail: NTIS HC A07/MF A01 CSCL 01C

Two main-rotor active control concepts, one incorporating multicyclic actuators located just below the swashplate, and the other providing for the actuators and power supplies to be located in the rotating frame are considered. Each design concept is integrated with cockpit controllers and displays appropriate to the actuation concept in each case. The benefits of applying the defined ACT/RCT concepts to rotorcraft are quantified by comparison to the baseline model 412 helicopter. These benefits include, in the case of one active control concept; (1) up to 91% reduction in 4/rev hub shears; (2) a flight safety failure rate of 1.96×10^{-6} to the 8th power failures per flight-hour; (3) rotating controls/rotor hub drag reduction of 40%; (4) a 9% reduction in control system weight; and (5) vibratory deicing. The related cockpit concept reduces pilot workload for critical mission segments as much as 178% visual and 25% manual.

A.R.H.

N83-17554* National Aerospace Lab., Tokyo (Japan). **THE ESTIMATION METHOD ON FLUTTER BOUNDARY FROM SUBCRITICAL RANDOM RESPONSES DUE TO AIR TURBULENCES: PROBLEMS OF TEST PROCEDURES AND DATA ANALYSIS**

Y. ANDO, Y. MATSUZAKI, H. EJIRI, and T. KIKUCHI 1982 19 p refs In JAPANESE; ENGLISH summary
(NAL-TR-718; ISSN-0389-4010) Avail: NTIS HC A02/MF A01

Flutter or divergence boundary from random responses due to turbulences in a flow are estimated. The model and equipment used, and the test procedure are described. The preliminary data processing in which values of the parameters used in the data analysis were selected are emphasized. The effects of the values on the estimation of the aeroelastic characteristics are shown changing them over a wide range. It is very important to use an appropriate combination of the width of the bandpass filter, sampled

interval, number of data points, maximum lag of covariance, etc.
S.L.

N83-17555* Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

CRITERIA FOR HANDLING QUALITIES OF MILITARY AIRCRAFT

R. J. WOODCOCK (AFWAL, Wright-Patterson AFB, Ohio) Oct 1982 22 p refs

(AGARD-AR-186; ISBN-92-835-1437-8) Avail: NTIS HC A02/MF A01

Criteria for handling qualities of military aircraft are discussed. Various aspects of this technology are considered: including equivalent systems, high order flight systems, gain and phase margin as a basis of longitudinal flying qualities, etc.
S.L.

N83-17556* Minnesota Univ., Minneapolis. Dept. of Aerospace Engineering and Mechanics.

EIGENSPACE TECHNIQUES FOR ACTIVE FLUTTER SUPPRESSION Final Report, Oct. 1981 - Dec. 1982

W. L. GARRARD and B. S. LIEBST Dec. 1982 107 p refs
(Contract NAG1-217)

(NASA-CR-169858; NAS 1.26:169858) Avail: NTIS HC A06/MF A01 CSCL 01C

Eigenspace (ES) techniques were used to design an active flutter suppression system for the DAST ARW-2 flight test vehicle. The ES controller meets control surface activity specifications and at the flutter test condition provides reduced wing root torsion at the gust test condition, and results in improved flutter boundaries. The ES controller is compared with a controller designed using Linear Quadratic (LQ) techniques. The LQ controller exhibits better phase margins at the flutter condition than does the ES controller but the LQ design requires large feedback gains on actuator states while the ES does not. This results in reduced overall actuator gain for the LQ design
Author

09

RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

A83-19663

THE TRANSONIC WIND TUNNEL BRAUNSCHWEIG OF DFVLR [DER TRANSSONISCHE WINDKANAL BRAUNSCHWEIG DER DFVLR]

E. STANEWSKY (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer experimentelle Stroemungsmechanik, Goettingen, West Germany), W. PUFFERT-MEISSNER, R. MUELLER, and H. HOEISEL (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer Entwurfs-Aerodynamik, Braunschweig, West Germany) Zeitschrift fuer Flugwissenschaften und Weltraumforschung, vol. 6, Nov.-Dec. 1982, p. 398-408. In German. refs

This paper describes the German 'Transonic Wind Tunnel Braunschweig' (TWB) of DFVLR. Topics of the discussion are the test set-up and the data acquisition system as well as a detailed description of a method for optimizing the test section wall geometry leading to a strong reduction in wall interference. To demonstrate the test quality and capacity of the TWB, the results obtained in this tunnel are compared to those of similar test facilities; furthermore, within the given possibilities, the influence of the Reynolds number on the flow about a specific transonic airfoil is outlined.
(Author)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

A83-19664

A WIND TUNNEL FOR UNSTEADY TURBULENT SHEAR FLOWS - DESIGN AND FLOW CALCULATION

H.-H. FERNHOLZ, J.-D. VAGT (Berlin, Technische Universitaet, Berlin, West Germany), and J. M. R. GRAHAM (Imperial College of Science and Technology, London, England) Zeitschrift fuer Flugwissenschaften und Weltraumforschung, vol. 6, Nov.-Dec. 1982, p. 408-416. NATO-supported research. refs

The main design characteristics and operation of an unsteady flow wind tunnel capable of generating streamwise oscillations in the flow of varying amplitude up to about 5 m/s and over a frequency range from less than 1 Hz to at least 50 Hz is described. The flow is approximately analyzed by linear acoustic theory. It is shown that a sinusoidal flow can be obtained in the working section when it is placed near the middle of the wind tunnel of suitably tuned length approximately equal to one quarter of the acoustic wavelength. However, because of the acoustic nature of the flow, considerable gradients in the velocity and static pressure amplitudes will occur along the tunnel, increasing in severity with increasing frequency. C.D.

A83-19949* Technion - Israel Inst. of Tech., Haifa.

AN OPTIMAL CONTROL APPROACH TO THE DESIGN OF MOVING FLIGHT SIMULATORS

R. SIVAN (Technion - Israel Institute of Technology, Haifa, Israel), J. ISH-SHALOM, and J.-K. HUANG (MIT, Cambridge, MA) IEEE Transactions on Systems, Man, and Cybernetics, vol. SMC-12, Nov.-Dec. 1982, p. 818-827 refs

(Contract E(11-1)-3070; NSG-2230; NSG-1323)

An abstract flight simulator design problem is formulated in the form of an optimal control problem, which is solved for the linear-quadratic-Gaussian special case using a mathematical model of the vestibular organs. The optimization criterion used is the mean-square difference between the physiological outputs of the vestibular organs of the pilot in the aircraft and the pilot in the simulator. The dynamical equations are linearized, and the output signal is modeled as a random process with rational power spectral density. The method described yields the optimal structure of the simulator's motion generator, or 'washout filter'. A two-degree-of-freedom flight simulator design, including single output simulations, is presented. O.C.

A83-20913

A TEST STAND FOR STUDYING TRANSIENT PHENOMENA IN AERODYNAMIC TURBOMACHINE CASCADES [EKSPERIMENTAL'NYI STEND DLIYA ISSLEDOVANIYA NESTATSIONARNYKH IAVLENII V AERODINAMICHESKIKH RESHETKAKH TURBOMASHIN]

A. L. STELMAKH, A. D. LEN, O. V. IVASHKEVICH, and A. A. KAMINER (Akademiia Nauk Ukrainsoi SSR, Institut Problem Prochnosti, Kiev, Ukrainian SSR) Problemy Prochnosti, Jan. 1983, p. 116-122. In Russian. refs

A test stand and test procedures for investigating the transient and aeroelastic phenomena arising from the interaction between turbine blades are briefly described. The test stand has provisions for the independent excitation of plane-parallel flexural, torsional, and flexural-torsional vibrations of the three central blades of plane cascades and for studying the aerodynamic damping and excitation of vibration under aerodynamic interaction between the blades in both homogeneous and periodically inhomogeneous flows. The design of the stand and the available instrumentation make it possible to vary the angle of attack from -10 to 25 deg and to study separated flow past the blades by hot-wire anemometry; the flow velocity is up to Mach 0.85. Examples of experimental data on the flexural vibrations of blades are presented. V.L.

A83-22158#

COMPACT INSTALLATION FOR TESTING VECTORED-THRUST ENGINES

W. H. CUNNINGHAM and J. F. BOYTOS (U.S. Naval Air Propulsion Test Center, Trenton, NJ) Journal of Aircraft, vol. 20, Mar. 1983, p. 229-235.

(Previously cited in issue 19, p. 3272, Accession no. A81-40967)

A83-22495

FIBER OPTICS FOR ELECTRO-MAGNETIC PULSE /EMP/ SIMULATORS

W. M. CATON (Maxwell Laboratories, Inc., San Diego, CA) In: Fiber optics in adverse environments; Proceedings of the Seminar, San Diego, CA, August 25-27, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 202-206. refs

Fiber optic cables were selected to transmit the command and data signals for a new EMP simulator, which will test the vulnerability of electronic systems to high intensity pulse electro-magnetic fields. The transient fields generated by the simulator induce large pulse currents in all coaxial cable and power wiring, and on the surfaces of all electronic enclosures in the vicinity of the EMP simulator sufficient to burn out unprotected electronics. Since no conductive current is induced on the all dielectric fiber optic cables, a major source of spurious signals and circuit damage was eliminated. The transmitters and receivers were essentially EMP hardened to protect from currents induced on the electronic enclosures. Two fiber optic data links transmit individual trigger signals with 1 ns risetimes from the command and control center to the two Marx generators situated on either side of the center of the horizontal dipole antenna of the simulator. Two additional fiber optic links transmit, back to the command and control center, the output from probes measuring the voltage developed across the Marx generators. These analogue data links have a 5 ns risetime and a 40:1 signal to peak noise ratio. The data links are 450 m long. (Author)

A83-22833

TWO YEARS OF TRAINING WITH THE FIRST TRUE THREE-DIMENSIONAL SIMULATOR

S. C. MCKINNEY (USAF, Castle AFB, CA) and J. LA RUSSA (Farrand Optical Co., Inc., Valhalla, NY) In: Visual simulation and image realism II; Proceedings of the Conference, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 23-28.

The design features and operations of the USAF boom operator part task trainer (BOPTT) for simulating the operations of the KC-135 refueling boom are described. The operator is required to lie on a pallet and peer through a window while guiding the airfoil-equipped boom to its locking position. Additionally, he directs the receiver pilot through radio contact or by means of directional lights on the bottom of the KC-135 aircraft. Design difficulties included accounting for different sized receiver aircraft, movement of the operator's head, and flight of the boom in a bow wave. It was found in comparison tests that experienced boom operators more accurately judged distances using the simulator than on actual flights. The true apparent depth of the receiver aircraft is projected as a function of its size, and background visual displays are provided. The display techniques for providing parallax, occultation, and stereopsis cues for the boom operator are outlined. M.S.K.

A83-22835**COMPUTER-GENERATED IMAGES IN VISUAL SIMULATION AND AVIONIC TECHNOLOGIES**

P. R. MARR (General Electric Co., Aircraft Equipment Div., Binghamton, NY) In: Visual simulation and image realism II; Proceedings of the Conference, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 36-43. Research supported by the Boeing Aircraft Co., General Electric Co., U.S. Air Force, U.S. Army, and U.S. Navy. refs

Different visual simulation systems are described as a means of showing the similarities, complexities, and requirements necessary to achieve an end product. The basic architecture of computer generated imagery (CGI) is outlined, noting the use of multiple processors to project an image which is updated every 1/30 sec. Visual simulation software is designed to acquire vehicle and moving model position and attitude data for input to the processing cycle, to initialize the active area data base, to monitor controls, interact with commands, and act as required, to transfer data and commands to the image processor, to monitor the processing status, and to implement actions commanded by status control or the operator. Avionics displays are noted to be configured for head-up display infinity images, flight control, engine monitor displays, and engine and flight management displays. Details of the processor hardware components needed for increasing CGI task complexity are reviewed. System architecture for a 767 aircraft is described. M.S.K.

A83-22836**PILOT TASK PROFILES, HUMAN FACTORS, AND IMAGE REALISM**

D. MCCORMICK (Singer Co., Link Flight Simulation Div., Sunnyvale, CA) In: Visual simulation and image realism II; Proceedings of the Conference, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 48-52. refs

The design criteria necessary to meet pilot requirements in the conception of a computer generated image (CGI) simulator for flight training are discussed. Attributes of the system edges or faces are specified according to the number of edges per unit area needed for scene realism, using a concentration of the density in specific areas. Correct positioning of the edges permits real-world projection of imagery such as dirt roads. The visual data base to choose the correct edges is developed from psychomotor tests, as well as knowledge of the conscious cues a pilot reacts to in-flight, i.e., checkpoints. Surface texture, including surface slant, must be provided for the pilot to function in a way that is transferrable to the real world. Rectangular solids are projected because of the common shape that humans have built most structures is rectangular. Circles and polygons may also be used where greater computer memory is available. M.S.K.

A83-22875**INFRARED CALIBRATION FACILITIES AT NEWARK AIR FORCE STATION**

J. L. GRANGAARD (USAF, Newark Air Force Station, Newark, OH) In: Contemporary infrared standards and calibration; Proceedings of the Meeting, San Diego, CA, August 25, 26, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 7-12.

The laser and infrared calibration facilities of the Aerospace Guidance and Metrology Center at Newark Air Force Station are described along with typical measurements. The laser lab has a complete set of primary standard calorimeters for accurate laser energy measurements. The nominal power, energy, and wavelength range of these standards are presented. The lasers used with these calorimeters include three carbon lasers with powers of 50 W, 250 W, and 1.5 kW, a 35-mW He-Ne laser, a 4-W krypton laser, argon lasers, a CW Nd:YAG laser with up to 200 kW of power, and a tunable dye laser with a power of 100 mW. The infrared lab maintains a set of primary standards of infrared radiance. These are NBS-built blackbodies with a graphite cavity that achieve an emissivity of 0.9999 ± 0.0001 , -0.0005 . The lab

also has a number of NBS traceable secondary standards, including a spectrally flat detector, optical pyrometers, standard lamps, reflectance standards, and wavelength standards. An example involving the calibration of an infrared target simulator is given. V.L.

A83-23240**REALISTIC 'FEEL' IN FLIGHT SIMULATORS IS BASED ON PRECISE CONTROL LOADING**

Aircraft Engineering, vol. 55, Feb. 1983, p. 10-12.

Flight simulators provide a trainee with a control column and rudder pedals which are weighted to represent the changing forces that act on actual aircraft control surfaces. These forces are coordinated with instruments, movement along several axes, and engine noise, as well as a visual display which realistically simulates pilot viewing from the cockpit. The frequent discrepancies between true forces of movement and those simulated can be eliminated by means of the Control Loading System retrofit package presently described. In addition, a Control Force Measurement System accomplishes the necessary fine tuning of simulator forces. The Control Loading System employs available electronic and hydraulic equipment, and is based on a primary force control loop which simulates both static and dynamic forces generated by analog simulation techniques. O.C.

A83-23241**THE SIMULATION OF FATIGUE LOADS IN AERONAUTICS [LA SIMULATION DES CHARGES DE FATIGUE EN AERONAUTIQUE]**

J. P. HERTEMAN and D. DEVILLER (Toulouse, Centre d'Essais Aeronautique, Toulouse, France) (Societe Francaise de Metallurgie, Journees de Printemps sur les Sollicitations en Service; Analyse et Simulation, Paris, France, May 11, 12, 1981.) Memoires et Etudes Scientifiques de la Revue de Metallurgie, vol. 80, Jan. 1983, p. 5-16. In French. refs

The principal characteristics of the signals and the techniques used in simulating fatigue in aircraft are reviewed. In the case of fatigue loading on aircraft wings, the nonstationary signals require a 'flight by flight' (ground/air/ground cycle) simulation. The asymmetric character of several accumulative features (range of maneuvers) necessitates the use of transition matrices or else arbitrary models which determine the average instantaneous force. Two types of tests are generally used to simulate fatigue loading in aeronautics. For preliminary tests, fatigue loading is tested using standard programs of the FALSTAFF or TWIST type, which provide a realistic evaluation of the optimal materials and technologies for the aircraft. For development or certification tests, programs of specific loading are employed to optimize the fatigue behavior in certain critical zones. N.B.

N83-16352# Federal Aviation Administration, Washington, D.C. Office of Airport Standards
MAINTENANCE OF AIRPORT VISUAL AID FACILITIES: ADVISORY CIRCULAR

26 Aug. 1982 113 p

(AC-150-5340-26) Avail: NTIS HC A06/MF A01

Recommended guidelines for maintenance of airport visual aid facilities are provided. Suggestions on establishing a preventive maintenance program are provided. Maintenance topics of a more general nature are addressed. Author

N83-16355# Naval Postgraduate School, Monterey, Calif.
EVALUATION OF HELICOPTER PILOT'S ATTITUDE CONTROL USING A SIMULATED HEAD-UP DISPLAY IN A SIMULATED HELICOPTER COCKPIT M.S. Thesis

M. C. STICHTER Jun. 1982 58 p refs

(AD-A119570) Avail: NTIS HC A04/MF A01 CSCL 051

As demands on the aviator's aeronautical, technical, and tactical skills increase, so must the employment of advanced cockpit design concepts. Advanced systems make for a reduced crew workload and a safer, more proficient mission capable aircraft. Six designated helicopter pilots (Navy, Marine Corps and Army) were evaluated on their ability to fly a simulated instrument flight regime using

09 RESEARCH AND SUPPORT FACILITIES (AIR)

only a head-up display as an attitude reference. Flight and control simulation was obtained through the construction of a generic helicopter cockpit, with dynamic gage indications generated by an analog computer. Two head-up display flights were flown with the display in the 12 o'clock and 2 o'clock positions. Their results were compared to an initial flight using cockpit instrumentation only. All three flights were identical profiles. Pilot performance was recorded graphically with strip charts and reduced into three performance zones. By averaging the percentage of time each pilot was in zone one, over each individual flight, it was shown that the average pilot's performance using the head-up display was within four to seven percentage points of their performance using only cockpit instrumentation. Author (GRA)

N83-16356# Canyon Research Group, Inc., Westlake Village, Calif.

APPLICATIONS OF SIMULATOR FREEZE TO CARRIER GLIDESLOPE TRACKING INSTRUCTION Final Report, 1 May 1980 - 31 Aug. 1981

R. G. HUGHES (AF Human Resources Lab.), G. LINTERN, D. C. WIGHTMAN (Naval Training Equipment Center), R. B. BROOKS (AF Human Resources Lab.), and J. SINGLETON (US Navy) Orlando, Fla. Naval Training Equipment Center Jul. 1982 58 p refs

(Contract N61339-78-C-0060; AF PROJ. 1123)
(AD-A118862; TR-81-023; NAVTRAEQUIPC-78-C-0060-9;
AFHRL-TR-82-3) Avail: NTIS HC A04/MF A01 CSCL 051

Twenty-five experienced F-4 and F-16 Air Force pilots were instructed in carrier landings in the Visual Technology Research Simulator (VTRS). The training was conducted under three instructional conditions, two of which employed the simulator's 'freeze' feature. Additionally, two methods of defining errors for carrier glideslope tracking were examined. These experimental training techniques were compared to a conventional training approach where no 'freezes' were imposed during the training sequence. While pilots who were trained under the 'freeze' condition developed control strategies that distinguished them from pilots trained by Conventional measures, no differences were found between these groups on rate of extent of learning. In response to a post experimental questionnaire, pilots who were trained under 'freeze' conditions indicated that the simulator 'freeze' was frustrating and added to the overall difficulty of the task. These pilots further reported being more motivated to avoid the 'freeze' than to perform the task correctly during training. A probe technique was used to examine differential transfer in lieu of the more traditional transfer-of-training technique. Although this experimental use of the probe technique was a preliminary effort, it does appear to hold promise for transfer-of-training experiments of this type.

Author (GRA)

N83-16358# Operations Research, Inc., Silver Spring, Md.

AIRPORT COMMUNITY SOUNDPROOFING AND RELOCATION STUDY Final Report

R. CHAIS, L. RONK, J. KIRKLAND, and J. SELWOOD Washington EPA Jul. 1982 192 p refs
(Contract EPA-68-01-6154)

(PB82-259144; EPA-550/9-82-343) Avail: NTIS HC A09/MF A01 CSCL 01E

For many airports, a residual population imported by aircraft noise will remain after benefits from all other noise control means have been realized. This report considers residential soundproofing and relocation programs as a means of achieving airport noise/land use compatibility. A detailed discussion of issues involved in such a program is given. To quantify the cost of such a program a methodology is developed and used to integrate parameters affecting noise exposure. A forecast is presented of changes in air carrier airport noise exposure that will occur during the balance of this century. The study also examines the noise exposure benefit of noise abatement flight operations, flight procedure, and restrictions on population encroachment. Soundproofing and relocation costs are developed for four airports. GRA

N83-16359# Environmental Protection Agency, Washington, D.C. Office of Noise Abatement and Control.

AIRPORT NOISE: LAND-USE COMPATIBILITY BY THE YEAR 2000

R. J. KOENIG and J. TYLER Aug. 1982 98 p refs
(PB82-259151; EPA-550/9-82-344) Avail: NTIS HC A05/MF A01 CSCL 01E

This report reviews the progress which has been made in airport noise control and presents a forecast of changes in aviation noise exposure that will occur during the balance of this century. Results are given of an analysis which examines the benefits of noise abatement flight operations, flight procedures and of restrictions on population encroachment, on residential noise exposure. Cost of residential soundproofing and relocation, based upon in-depth studies, are presented for four air carrier airports which represent four airport categories. While the main focus of the report is on noise exposure above Ldn 65 at air carrier airports, noise exposure around general aviation and joint-use civil/military airports is also discussed. GRA

N83-17558# Federal Aviation Administration, Atlantic City, N.J. Technical Center.

EVALUATION OF RETROREFLECTIVE PAVEMENT MARKERS FOR PRECISION AND NONPRECISION RUNWAYS Interim Report, Mar. 1981 - Jun. 1982

G. S. BROWN Washington Dec. 1982 27 p refs
(Contract FAA PROJ. 081-502-520)

(FAA-CT-82-112; FAA-RD-82-83) Avail: NTIS HC A03/MF A01

The purpose of this program was to evaluate the use of retroreflective pavement markers, installed in a configuration duplicating runway centerline and touchdown zone lighting system of a Category 2 runway on Category 1 or Nonprecision Approach runways with edge lighting to determine if these retroreflective markers will enhance nighttime visual guidance to provide increased safety of operations and possible reduction in minimums, particularly under wet runway conditions. Visual contact height with the retroreflective pavement marker systems was not enhanced prior to reaching Minimum Descent Altitude (MDA) or Decision Height (DH) for nonprecision or Category 1 approaches respectively; therefore, this system will not permit the reduction in approach minimums for Category 1 precision or nonprecision approaches. However, the test program demonstrated that the system is effective in improving the safety of operation for final approach, flare and touchdown, landing rollout, and for takeoffs. Particularly under rainy, wet nighttime conditions, the pavement retroreflector significantly enhanced the visual guidance, supplementing that provided by the standard runway edge lights and paint markings which are difficult to see under wet conditions. Author

N83-17559# Federal Aviation Administration, Atlantic City, N.J. Technical Center.

EVALUATION OF SUPPLEMENTAL LIGHTS FOR CAUTION BARS Final Report, Feb. - Sep. 1982

L. W. HACKLER Washington Dec. 1982 25 p refs
(Contract FAA PROJ. 081-502-590)

(FAA-CT-82-119; FAA-RD-82-79) Avail: NTIS HC A02/MF A01

Caution Bars (stop bars or hold bars) are used to identify taxiway hold lines and warn pilots of an approaching runway. Caution Bars are difficult to see when they are covered by snow or sand, or when a high cockpit aircraft is at or close to the caution bars. Under these conditions, supplemental lights (taxi holding position lights) could help. This project was to determine the desired characteristics of horizontal and vertical coverage, intensity, flash rate, and orientation of the supplemental lights. The results indicated that these characteristics were acceptable or desired. The results also indicated that the lights would enhance identification of the taxi holding position. B.W.

N83-17560* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

THE AERODYNAMIC PERFORMANCE OF SEVERAL FLOW CONTROL DEVICES FOR INTERNAL FLOW SYSTEMS

W. T. ECKERT (Army Aviation Research and Technology Labs.), B. M. WETTLAUFER (Sverdrup Technology), and K. W. MORT
Dec. 1982 49 p refs Sponsored in part by Army Aviation Research and Development Command
(NASA-TP-1972; A-8816; NAS 1.60.1972;
AVRADCOM-TR-81-A-2) Avail: NTIS HC A03/MF A01 CSCL 14B

An experimental research and development program was undertaken to develop and document new flow-control devices for use in the major modifications to the 40 by 80 Foot wind tunnel at Ames Research Center. These devices, which are applicable to other facilities as well, included grid-type and quasi-two-dimensional flow straighteners, louver panels for valving, and turning-vane cascades with net turning angles from 0 deg to 90 deg. The tests were conducted at model scale over a Reynolds number range from $2 \times 100,000$ to $17 \times 100,000$, based on chord. The results showed quantitatively the performance benefits of faired, low-blockage, smooth-surface straightener systems, and the advantages of curved turning-vanes with hinge-line gaps sealed and a preferred chord-to-gap ratio between 2.5 and 3.0 for 45 deg or 90 deg turns. Author

N83-17562* Technische Hochschule, Aachen (West Germany). Verkehrswissenschaftlichen Inst.

AIDS TO DECISION MAKING IN AIRPORT PLANNING

P. WOLF Dec. 1981 249 p refs In GERMAN; ENGLISH summary
(REPT-34) Avail: NTIS HC A11/MF A01

A computer model designed to serve as an aid to decision-making in operational planning and control of new passenger terminals is described. The methodological procedure, the bases for programming, and the testing of the plausibility of the computer model are described. Applications of the computer simulation procedure are outlined including the effects of various parameter alterations. These parameters include: flight plan and load factor of aircraft based on the use of larger aircraft types; passenger processing procedures based on the processing of all passengers by one processing company; and passengers' behavior on arrival at the terminal in cases where check-in time is brought forward owing to stricter security checks. The effects of these parameters on waiting time for passengers and baggage and utilization of the most important terminal areas and the apron are addressed in relation to the processing procedures involved and the personnel strength available for processing. The effects of parameter alterations are shown and discussed for several examples. J.M.S.

10

ASTRONAUTICS

Includes astronautics (general); astrodynamics; ground support systems and facilities (space); launch vehicles and space vehicles; space transportation; spacecraft communications, command and tracking; spacecraft design, testing and performance; spacecraft instrumentation; and spacecraft propulsion and power.

A83-22657

THE IDEAS OF F. A. TSANDER AND AN ASSESSMENT OF THE APPLICATION OF JET ENGINES FOR THE ACCELERATION OF AEROSPACE VEHICLES [IDEI F. A.

TSANDERA I OTSENKA PRIMENENIIA VRD DLIA RAZGONA VOZDUSHNO-KOSMICHESKIKH LETATEL'NYKH APPARATOV] I.U. M. ANNUSHKIN In: Theory and design of flight-vehicle engines. Moscow, Akademiia Nauk SSSR, 1979, p 81-99. In Russian. refs

After a brief review of Tsander's ideas, the paper examines the feasibility of using hydrogen supersonic combustion ramjet engines to accelerate aerospace and shuttle-type vehicles. Particular consideration is given to the working process in scramjet-engine combustion chambers, and to the thrust characteristics of scramjet engines and the acceleration characteristics of aerospace vehicles. Theoretical assessments indicate that hydrogen scramjet engines are suitable for accelerating aerospace vehicles to Mach 10-12. B.J.

N83-16386* Research Inst. of National Defence, Stockholm (Sweden)

A LIMITED STUDY OF THRUST VECTOR CONTROL WITH GUIDE VANES AND JET RUDDER [EN BEGRAENSAD STUDIE KRING TVC MED JETAVATOR OCH STRAALRODER]

R. ELIASSON Apr. 1982 32 p refs In SWEDISH
(FOA-C-20455-E3) Avail: NTIS HC A03/MF A01

Thrust vector control for the control of jet propelled remote controlled vehicles was studied in test stands on a liquid propellant rocket engine. With guide vanes the impulse loss is 9 to 10 %; the impulse direction does not go through the rotation center of the guide vane. The impulse loss of the jet rudders is 7 to 8 %; tungsten rudders show the best heat resistance. Author (ESA)

N83-17564* Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

ACTIVITIES REPORT OF THE FRENCH AEROSPACE AND RESEARCH INDUSTRY Annual Report, 1981

24 May 1982 246 p refs Transl. into ENGLISH from original FRENCH Original contains color illustrations
Avail: NTIS HC A11/MF A01

The solution of the difficult and varied problems raised by aircraft and spacecraft design involves multiple disciplines and techniques, some of which lie outside the traditional aerospace area (data processing, solid state physics, coherent optics). The activities in the fields of physics, structures, aerodynamics, materials, systems, computer science and energetics are reported. S.L.

N83-17574 Pnns Maunts Lab. TNO, Rijswijk (Netherlands). Inst. voor Chemische en Technologische Research.

GENERAL BASIC CONCEPTS FOR A TRAJECTORY SIMULATION OF A GUIDED MISSILE

P. W. DOUP Jul. 1981 51 p refs
(Contract A76/KM/029)

(PML-1981-36; TDCK-76160) Avail: Issuing Activity

Basic concepts needed for a flight path simulation of a guided missile were collected. Special attention is given to a missile with variable mass. The dynamic equations of motion are applied to a rigid body structure and the kinematic relationships are restricted to a missile flying over a nonrotating Earth. E.A.K.

CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; and propellants and fuels.

A83-19846**EFFECTS OF ENVELOPE FLAMES ON DROP GASIFICATION RATES IN TURBULENT DIFFUSION FLAMES**

G. A. SZEKELY, JR. and G. E. FAETH (Pennsylvania State University, University Park, PA) Combustion and Flame, vol 49, Jan. 1983, p. 255-259. refs
(Contract N00014-80-C-0517; F33615-81-K-2039)

Predicted and measured steady gasification rates of JP-10 drops supported at various locations in an open turbulent diffusion flame are compared. Predictions were made considering both the presence and absence of envelope flames since they were observed for some positions where the local mean fuel equivalence ratio was less than unity. Predictions were in good agreement with measurements as long as the existence of envelope flames could be specified for local mean fuel equivalence ratios less than 0.9. (Author)

A83-20082#**FUEL FOR FUTURE TRANSPORT AIRCRAFT**

G. D. BREWER (Lockheed-California Co., Burbank, CA) Mechanical Engineering, vol. 105, Jan. 1983, p. 50-55.

The advantages of introducing liquid hydrogen (LH2) as aircraft fuel to replace Jet A are described, noting its superiority to other alternatives such as kerosene and liquid methane. Hydrogen can be produced by either electrolytic or thermochemical water splitting, thus making it producible anywhere in the world, a condition which is not offered by the unequal distribution of the global fossil fuels. Hydrogen's low density, low boiling point, and high diffusion velocity in air are factors which make it inherently safer than hydrocarbon fuels, especially in a crash. LH2 combustion and production do not contribute to the global CO2 problem. NASA studies have indicated that LH2 is suitable for aircraft flying routes ranging from 1500-10,600 n. mi., with higher performance, i.e., ultimate energy efficiency than conventional fuels or kerosene. An economic analysis for a steam-reformation of coal process to produce LH2, if carried out as part of a cogeneration operation, would yield LH2 fuel costing less than aviation-grade kerosene. A time frame for developing the technologies necessary for the total replacement of hydrocarbon-based fuels with LH2 is outlined. M.S.K.

A83-20429**A NEW HIGH IMPACT RESIN SYSTEM FOR ADVANCED COMPOSITES WITH 300 F /150 C/ PROPERTIES**

L. C. HOPPER and E. S. HARRISON (Narmco Materials, Inc., Costa Mesa, CA) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. A Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 23-31.

The present investigation is concerned with the development of a new high impact resin system. The newly formulated Narmco 5245 resin system is combined with a new high strain carbon fiber. The resulting materials are suitable for use as primary load bearing structure in today's subsonic aircraft. Attention is given to preliminary screening methods used in evaluations of relative toughness levels of experimental formulations. Use was made of 3K-70P carbon fabric as reinforcement in a five ply layup. Composite data representative of the obtained materials are listed in a number of tables, and aspects of resin rheology are discussed. G.R.

A83-20442**EFFECT OF MOISTURE ON ADHESIVELY BONDED TITANIUM STRUCTURES**

M. NATAN, J. D. VENABLES, and K. R. BREEN (Martin Marietta Laboratories, Baltimore, MD) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 178-191. refs
(Contract N00019-80-C-0508)

The effects of moisture on the morphology and crystal structure of oxides on Ti adherends prepared for adhesive bonding by four processes used in the aerospace industry have been studied with high resolution SEM, TEM, electron diffraction, and AES. The combination of moisture and elevated temperatures leads to a polymorphic transformation of the original amorphous oxide to crystalline anatase through a dissolution-precipitation mechanism. The surface of a lap shear specimen pulled in tension in dry air at 200 F (93 C) exhibits a crystalline oxide structure, possibly indicating a connection between oxide crystallization and adhesive bond failure. (Author)

A83-20448**THE EFFECT OF PRIMER-ADHESIVE COMPATIBILITY ON ADHESIVE PEEL STRENGTH AT LOW TEMPERATURE**

T. D. NG and D. L. PARADIS (Dexter Corp., Pittsburgh, CA) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 336-345 refs

A83-20481**PLASTIC TOOLING FOR ADVANCED COMPOSITES**

A. B. KERR (Fiber-Resin Corp., Burbank, CA) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 830-834.

The employment of epoxy tooling has been an important factor in the development of the aircraft industry. However, in connection with the use of new materials in aircraft construction, such as the widescale employment of Kevlar and graphite composites, improvements are being required over the usual wet layup epoxy/fiberglass tooling. It is believed that a high quality prepreg, designed expressly for tooling, is part of the answer to improved aircraft tooling. Advantages of tooling prepreg are related to proper resin content of the laminate, the absence of delamination between plies caused by limited pot life of wet resins, the better mechanical properties, and the ability of unskilled workers to adapt easily to prepreg. A description is presented of the development of tooling prepreg FR 8618. It is pointed out that properly used, tooling prepreg should provide superior tools in 350 F. autoclave environments. G.R.

A83-20484**DAMAGE TOLERANCE AND REPAIRABILITY OF ADVANCED COMPOSITE STRUCTURES**

N. CARAVASOS and J. P. DONNELLY (Boeing Vertol Co., Philadelphia, PA) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 865-873. refs

Helicopter rotor blades have been repaired in the field, and hybrid aircraft construction panels using Kevlar/epoxy and Kevlar-graphite/epoxy for increased stiffness have also been repaired. The present investigation is concerned with the damage tolerance of composites, taking into account differences in the behavior of damaged composite and metal structures. It is pointed out that composite materials have an attractive characteristic of resisting crack propagation. To examine the battle damage tolerance of composite materials, and flight load carrying capability of a tail rotor system was investigated. Attention is also given to the fabrication of a composite test panel, the conduction of ballistic tests with the test panel, and the repair of the panel. At the

completion of the repair, the test panel was structurally tested by shearing the panel to failure. G.R.

A83-20497

THE EFFECT OF LOADING RATES, TEMPERATURE AND MOISTURE ON THE FRACTURE TOUGHNESS OF POLYCARBONATE

S. A. SUTTON, R. W. THOMAS, P. W. MAST, I. WOLOCK (U.S. Navy, Naval Research Laboratory, Washington, DC), and J. TIROSH In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 1003-1021. Navy-supported research. refs

The present investigation is concerned with the conditions under which a successful fracture toughness test for polycarbonate could be performed. A fracture toughness test method developed for stretched acrylic by Sutton (1978) was studied for extension to polycarbonate. It is found that a standard fracture mechanics test can be used to characterize the fracture toughness of polycarbonate plastic over a broad range of conditions. A precracking technique was developed which can be used for this material. For the range of conditions investigated, the data obtained indicate that the fracture toughness, K_{Ic} , increases slightly with decreased loading rate and more dramatically with increased temperature. There was little difference in fracture toughness between the dry polycarbonate and material at equilibrium with the standard laboratory environment (0.15% moisture content) G.R.

A83-20499

ELEVATED TEMPERATURE REPAIRS OF ADVANCED COMPOSITE STRUCTURES

L. ROBERTS (Heat Tecna Precision Structures, Inc., Kent, WA) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 1038-1043.

The extensive use of advanced composite materials in the Aerospace industry has proven to be an effective means of obtaining highly desirable strength to weight ratios for improved aircraft performance. The tremendous growth in their application has increased the need for reliable repair systems. A brief review of two types of repair methods is given. A description of the new state of the art, portable repair systems that have recently become available, is given. (Author)

A83-21014#

INVESTIGATION OF SLURRY FUEL PERFORMANCE FOR USE IN A RAMJET PROPULSOR

I. PELEG (Raphael Armament Development Authority, Propulsion Dept., Haifa, Israel) and Y. M. TIMNAT (Technion - Israel Institute of Technology, Haifa, Israel) In: Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers. Haifa, Technion - Israel Institute of Technology, 1982, p. 102-110. refs

A theoretical examination of the use of light-element slurries as fuels in ramjet applications is presented. The heat and density of B, Al, Mg, and C are noted to be higher than the same properties obtainable from hydrocarbon fuels, while materials and mechanical considerations require that the slurries be thin enough to be pumped and injected into the combustion chamber. The settling rate is calculated for particles suspended in kerosene, and it is found that a slurry with thixotropic properties is best suited, since a high viscosity retards the settling of the particles. The thixotropy can be produced by the introduction of gelling agents into the kerosene fuel while still maintaining a high shear rate. Computer simulations have modeled the specific impulse and flame temperature values for kerosene, kerosene with boron, and kerosene with aluminum slurries with various particle densities by volume. The highest possible additions of B are recommended although, if no volume restrictions or maneuvering constraints are necessary, then kerosene alone has suitable performance. M S K.

A83-21048

AGING AND PERFORMANCE OF STRUCTURAL FILM ADHESIVES. I - A COMPARISON OF TWO HIGH-TEMPERATURE CURING, EPOXY-BASED SYSTEMS

P. J. PEARCE, R. G. DAVIDSON, and C. E. M. MORRIS (Department of Defence, Materials Research Laboratories, Ascot Vale, Victoria, Australia) Journal of Applied Polymer Science, vol. 27, Nov 1982, p. 4501-4516. refs

The room temperature aging of two epoxy adhesives, both of which are cured at 177 C and contain the moisture sensitive resin triglycidyl(4-aminophenol), has been examined. It has been found that hydrolysis of this resin is the major cause of reduction in epoxide content during aging. This in turn is largely responsible for the deterioration in the performance, especially at high temperatures, of bonded joints made with aged adhesive. The advantages of using high purity resins in adhesive formulations have been demonstrated. (Author)

A83-21454

THE CORROSION RESISTANCE OF PROTECTIVE COATINGS

M. MALIK (Lufthansa AG, Hamburg, West Germany), R. MORBIOLI (SNECMA, Evry, Essonne, France), and P. HUBER (Gebrüder Sulzer AG, Winterthur, Switzerland) In: High temperature alloys for gas turbines 1982, Proceedings of the Conference, Liege, Belgium, October 4-6, 1982. Dordrecht, D. Reidel Publishing Co., 1982, p. 87-98. refs

Protective coatings used on industrial and aircraft gas turbine blades are evaluated to assess their performance under conditions typical for modern gas-turbine engines. The coatings examined include diffusion coatings, particularly those of the Pt-aluminide system; plasma-sprayed coatings (e.g., CrSiBNi, CrNiTaAlYCo, and CrNiSiBCo), and CoCrAlY and NiCrAlY coatings obtained by physical vapor deposition techniques. Consideration is given to the following aspects: the coating requirements, the relative corrosion resistance of coatings based on laboratory and rig tests, the effect of the coatings on the mechanical properties and structural stability of the coating/substrate system, performance evaluation in service, and criteria for the re-application of coatings on worn turbine blades. V.L.

A83-21467* Columbia Univ., New York

EFFECTS OF COBALT IN NICKEL-BASE SUPERALLOYS

J. K. TIEN and R. N. JARRETT (Columbia University, New York, NY) In: High temperature alloys for gas turbines 1982; Proceedings of the Conference, Liege, Belgium, October 4-6, 1982. Dordrecht, D. Reidel Publishing Co., 1982, p. 423-446. NASA-sponsored research. refs

A study has been carried out to assess the role of cobalt in Udimet 700, a representative nickel-base superalloy containing 17 percent or more cobalt. The study spans the spectrum of microstructural, microchemical, and mechanical behavior aspects which together form a basis for superalloy performance in jet engines. The results suggest that cobalt affects the solubility of elements in the gamma matrix, which leads to enhanced gamma-prime volume fraction and to the stabilization of MC-type carbides and sigma phase. However, these microstructural and microchemical changes are too slight to significantly affect the strength and ductile properties. Depending on the heat treatment, the creep and stress rupture resistance can be cobalt-sensitive. In the coarse-grained, fully solutioned and aged condition, all of the alloy's 17 percent Co can be replaced by nickel without decreasing the creep and stress rupture resistance. These findings are discussed with reference to existing theories and experimental data obtained by other workers. V.L.

A83-21470

THE INTERACTION OF HIGH TEMPERATURE CORROSION AND MECHANICAL PROPERTIES OF ALLOYS

H. W. GRUNLING (Brown Boveri et Cie. AG, Mannheim, West Germany), K. H. KEIENBURGH (Kraftwerk-Union AG, Mulheim, West Germany), and K. K. SCHWEITZER (Munich, Technische Universität, Munich, West Germany) In: High temperature alloys for gas turbines 1982; Proceedings of the Conference, Liege, Belgium, October 4-6, 1982. Dordrecht, D. Reidel Publishing Co., 1982, p. 507-543. refs

Hot corrosion data on gas-turbine superalloys are summarized, with emphasis placed on interactions between high-temperature corrosion relevant to industrial (utility), marine, and jet engine turbine applications and the time-dependent mechanical properties of creep and fatigue. Test results for Ni- and Co-base alloys show that corrosion-related loss of cross-sectional area and notching as well as additional bending stresses due to nonuniform corrosion attack overbalance other effects on creep rupture properties. However, in a purely sulfidizing/oxidizing environment, at stress levels relevant to practical use, no synergistic effects are observed. Fatigue properties of the alloys seem to be influenced by the same external and internal structural changes, and the effects of corrosion on crack initiation and crack propagation can be distinguished. V.L.

A83-21481

FATIGUE FAILURE UNDER FRETTING CONDITIONS

Y. LINDBLOM and G. BURMAN (FFV, Maintenance Div., Linköping, Sweden) In: High temperature alloys for gas turbines 1982; Proceedings of the Conference, Liege, Belgium, October 4-6, 1982. Dordrecht, D. Reidel Publishing Co., 1982, p. 673-684. refs

Fretting, which occurs when two adjoining surfaces are in contact under a clamping load, can have a severely adverse effect on the effective fatigue life of aircraft gas turbine components. The Coulomb type of friction which is characteristic of the tangential forces on adjoining surfaces is proportional to the load and the coefficient of friction. In the present case of adjoining turbine disk surfaces, it is shown that most of the projected fatigue life of these components can be recovered through a reduction of the coefficient of friction by means of lubricants and an introduction of compression stresses into the adjoining surfaces. O.C.

A83-21493

THE RELATIONSHIP BETWEEN STRUCTURE, PROPERTIES AND PROCESSING IN POWDER METALLURGY SUPERALLOYS

J. H. DAVIDSON (Imphy, S.A., Imphy, Nièvre, France) and C. AUBIN (Paris, Ecole Nationale Supérieure des Mines, Evry, Essonne, France) In: High temperature alloys for gas turbines 1982; Proceedings of the Conference, Liege, Belgium, October 4-6, 1982. Dordrecht, D. Reidel Publishing Co., 1982, p. 853-886. refs

An interpretation in light of microstructural and analytical observations of loose particles and consolidated products is given for the influence of composition, powder production technique, and processing parameters on the mechanical properties and weldability of PM superalloys. Emphasis is placed on the consequences of powder particle surface structure and composition for the selection of processing parameters. It is noted that the optimum consolidation and heat treatment conditions, together with the required inclusion of a forging step in the processing sequence, are intimately related to powder particle surface characteristics. O.C.

A83-21757

PRACTICAL APPLICATION OF A MODEL FOR FATIGUE DAMAGE WITH IRREGULAR CYCLIC LOADING

H. FUEHRING (Fraunhofer-Institut fuer Betriebsfestigkeit, Darmstadt, West Germany) In: Advances in fracture research; Proceedings of the Fifth International Conference on Fracture, Cannes, France, March 29-April 3, 1981. Volume 4. Oxford, Pergamon Press, 1982, p. 1823-1832. refs

A new load-sequence model describing fatigue crack growth is presented which takes into account nonlinear effects, such as

retardation, acceleration, and multiple load interaction. Working on a cycle-by-cycle basis, the model uses a modified stress intensity range to allow for the effect of all previous load cycles on the current damage state. The prediction accuracy of the model proposed here is demonstrated by comparing test results against crack growth predictions based on conventional linear theory and on the load-sequence model. V.L.

A83-21802

AN IMPROVED METHODOLOGY FOR PREDICTING RANDOM SPECTRUM LOAD INTERACTION EFFECTS ON FATIGUE CRACK GROWTH

J. B. CHANG, M. SZAMOSSY (Rockwell International Corp., North American Aircraft Div., Los Angeles, CA), and R. M. ENGLE (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH) In: Advances in fracture research; Proceedings of the Fifth International Conference on Fracture, Cannes, France, March 29-April 3, 1981. Volume 6. Oxford, Pergamon Press, 1982, p. 2761-2769. USAF-sponsored research. refs

Fatigue crack-growth data for center-through cracks contained in 2219-T851 aluminum plates subjected to random spectrum loadings were generated. A crack-growth prediction methodology which accounts for overload retardation and compressive load acceleration effects on fatigue crack-growth was developed using the generalized Willenborg retardation model as the base. Fatigue crack-growth analyses were performed employing the proposed methodology. Analytical predictions were correlated to the test data. Good correlations were shown. (Author)

A83-22019* Cincinnati Univ., Ohio.

METALLURGICAL INSTABILITIES DURING THE HIGH TEMPERATURE LOW CYCLE FATIGUE OF NICKEL-BASE SUPERALLOYS

S. D. ANTLOVICH and N. JAYARAMAN (Cincinnati, University, Cincinnati, OH) Materials Science and Engineering, vol. 57, Jan. 1983, p. L9-L12. refs

(Contract AF-AFOSR-80-0065; NSG-3263)

An investigation is made of the microstructural instabilities that affect the high temperature low cycle fatigue (LCF) life of nickel-base superalloys. Crack initiation processes, provoked by the formation of carbides and the coarsening of the grains of the material at high temperatures are discussed. Experimental results are examined, and it is concluded that LCF behavior can be understood more fully only if details of the material and its dynamic behavior at high temperatures are considered. The effects of high stress, dislocation debris, and increasing environmental damage on the life of the alloy are discussed. M.I.I.

A83-22166#

SONIC FATIGUE OF ADVANCED COMPOSITE PANELS IN THERMAL ENVIRONMENTS

M. J. JACOBSON (Northrop Corp., Hawthorne, CA) Journal of Aircraft, vol. 20, Mar. 1983, p. 282-288. refs

(Contract N62269-80-C-0240)

(Previously cited in issue 20, p. 3476, Accession no. A81-43160)

A83-22263

EVALUATION OF AIR-COOLED Si3N4 VANES

M. I. MENDELSON, R. R. GAILFOIL (United Technologies Corp., Government Products Div., West Palm Beach, FL), and D. W. ZABIEREK (USAF, Wright Aeronautical Laboratories, Wright-Patterson AFB, OH) Ceramic Engineering and Science Proceedings, vol. 3, Sept.-Oct. 1982, p. 630-641. refs

Four conceptual gas turbine vane-cooling designs were formulated in order to test tensile stresses in air-cooled Si3N4 vanes which have been predicted to be lower than those of uncooled solid vanes of this material. The four alternatives were analyzed in light of design criteria which included a 1780 K maximum temperature, 138,000 kPa maximum stress, and ease of fabrication and high reliability with low production cost. Hollow core vane designs with and without trailing edge holes satisfied these criteria under conditions of high coolant flow, and were

successfully tested at steady-state 1920 K for 20 min and 1810 K for 45 min, as well as under cyclic temperatures in the 1730-865 K range. In light of these results the ability of cooled Si₃N₄ vanes to survive high temperatures and transient cooldowns has been demonstrated. O.C.

A83-22595

GRAPHITE/EPOXY MATERIAL CHARACTERISTICS AND DESIGN TECHNIQUES FOR AIRBORNE INSTRUMENT APPLICATION

J. E. STUMM, G. E. PYNCHON, and G. C. KRUMWEIDE (Composite Optics, Inc., San Diego, CA) In: Airborne reconnaissance V; Proceedings of the Seminar, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1981, p. 188-198.

The increasingly stringent performance requirements for airborne sensor systems will eventually exceed the capability of conventional materials and fabrication techniques to provide satisfactory design solutions. This will occur, historically, in the areas of inertial properties, stiffness and dimensional stability. A possible solution for enhancing performance in these areas is the appropriate application of graphite/epoxy composite materials; however, certain principles of application must be observed in its use in order to achieve the optimum result. In the paper, the practical aspects of utilizing graphite/epoxy in an airborne environment are discussed and the incorporation of these principles in practical structures is illustrated with respect to optical mirror substructure, telescope and camera structure, instrument mounting platforms and ultra-lightweight radiometer reflectors. (Author)

A83-23138#

SOOTING TENDENCY OF FUELS CONTAINING POLYCYCLIC AROMATICS IN A RESEARCH COMBUSTOR

D. W. NAEGELI, L. G. DODGE, and C. A. MOSES (Southwest Research Institute, San Antonio, TX) Journal of Energy, vol. 7, Mar.-Apr. 1983, p. 168-175. refs

(Previously cited in issue 07, p. 1004, Accession no. A82-19791)

N83-16397*# Lockheed-California Co., Burbank.

REPAIR TECHNIQUES FOR GRAPHITE/EPOXY STRUCTURES FOR COMMERCIAL TRANSPORT APPLICATIONS Final Report R. H. STONE Hampton, Va. NASA. Langley Research Center Jan. 1983 206 p refs Previously announced in IAA as A81-43645

(Contract NAS1-15269)

(NASA-CR-159056; NAS 1.26:159056) Avail: NTIS HC A10/MF A01 CSCL 11D

Composite defect sensitivity and airline damage experience and repair capabilities were surveyed. Repair concepts were screened. Repair of subelement specimens was covered. Author

N83-16401# Dayton Univ., Ohio.

MATERIALS SCREENING TESTS OF THE FOD IMPACT DESIGN TECHNOLOGY PROGRAM, TASK 4C Final Technical Report, Oct. 1977 - Jun. 1980

R. S. BERTKE Wright-Patterson AFB, Ohio AFWAL Feb. 1982 68 p refs

(Contract F33615-77-C-5221; AF PROJ. 3066)

(AD-A119839; UDR-TR-81-14; AFWAL-TR-82-2043) Avail: NTIS HC A04/MF A01 CSCL 11D

This report describes a study to develop screening tests to identify and evaluate candidate fan and compressor blade materials of aircraft engines which may possess superior foreign object damage (FOD) resistance. Tests were developed to determine the ballistic limit, local deformation characteristics, gross structural damage characteristics, and the fatigue strength of candidate blade materials. The data generated demonstrated that the screening tests utilized could rate and rank the candidate materials investigated. The materials investigated included 8A1-1Mo-IV and 6A1-4V titaniums, 410 stainless steel in the annealed and heat-treated conditions, a boron/aluminum composite, and a graphite/epoxy composite. Based on the results, the titanium alloys

were superior followed by the stainless steel material. The composites showed very poor response to the screening tests and were ranked last. Equations were developed for each screening tests which can be used to determine the response of new candidate materials to foreign object damage. Author (GRA)

N83-16402# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.

MATERIAL CHARACTERIZATION. PART B: MECHANICAL PROPERTIES OF 2 METAL MATRIX COMPOSITE MATERIALS Interim Technical Report, 1 Oct. 1977 - 30 Jun. 1980

S. A. EMERY May 1982 49 p refs

(Contract F33615-77-C-5221; AF PROJ. 3066)

(AD-A119829; UDR-TR-80-37-VOL-2; AFWAL-TR-82-2042-VOL-2)

Avail: NTIS HC A04/MF A01 CSCL 11D

This report describes mechanical property data collected in support of a fan blade analysis model. The development of the blade model is part of a foreign object damage (FOD) study of jet engine fan blades. Use of the properties in the model allows one to evaluate potential fan blade materials. Part A of this report contains a discussion of the mechanical property tests conducted on two metallic materials: 410 stainless steel and 8A1-1Mo-1V titanium. These two materials were selected because of their use in the J-79 blade and F-101 blade, respectively. Part B of the report contains a discussion of mechanical property tests conducted on the two composite components of a hybrid composite blade: boron/2024 aluminum and stainless steel wire mesh/2024 Aluminum. These two composites are used in the hybrid composite APSI blade. Quasi-static tensile tests and torsional tests were conducted on unidirectional specimens for the two composites indicated above. GRA

N83-16417*# California Univ., Berkeley. Dept. of Chemical Engineering.

ANTI-MISTING ADDITIVES FOR JET FUELS Final Technical Report, 1 Jan. - 30 Sep. 1982

E. A. GRENS, II and M. C. WILLIAMS 1982 10 p refs

(Contract NCC2-164)

(NASA-CR-169751; NAS 1.26:169751) Avail: NTIS HC A02/MF A01 CSCL 21B

The ignition characteristics of sprays, created by wind shear action, of Jet-A fuel containing polyisobutylene additives were examined over ranges of air velocities from 45 to 90 m/s and of fuel/air mass ratios of 0.20 to 8.0. Ignition was by calibrated sparks of energies up to about 0.5 J and by a butane/oxygen flame at 165 J/s. The polymeric additives studied included the grades L80, L160, and L200 from Exxon Chemical and B200 and B230 from BASF. The ignition suppression ability of the additives, as well as their observed anti-misting (AM) behavior, ranked exactly as their molecular weights (viscosity average, $M_{sub v}$) with 400-500 ppm of L80 ($M_{sub v} = 0.68 \times 1,000,000$) being required to suppress ignition of a spray at 51 m/s, 1.8 fuel/air mass ratio, by a 0.55 J spark while only 10 ppm of B230 ($M_{sub v} = 7.37 \times 1,000,000$) was required for the same conditions. The additive concentrations (L160) required for ignition suppression increased with increasing air velocity and with increasing fuel/air ratio. Author

N83-16492*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

OPTICAL OBSERVATIONS OF UNIDIRECTIONAL SOLIDIFICATION IN MICROGRAVITY

M. H. JOHNSTON, R. B. OWEN, and R. E. SHURNEY Jan. 1983 28 p refs

(NASA-TP-2110; NAS 1.60:2110) Avail: NTIS HC A03/MF A01 CSCL 11F

Optical interferometric, shadowgraph, and streak photographic methods are used to obtain temperature profiles, concentration gradients, and fluid velocities in NH₄Cl-H₂O metal-model solution during unidirectional solidification in microgravity. This study elucidates earlier low gravity suborbital rocket experiments and lays the groundwork for space shuttle experiments. The design and operation of the optical units are presented, and results are detailed to ground based experiments. The low gravity experiments

11 CHEMISTRY AND MATERIALS

were conducted using a KC-135 aircraft flying a parabolic trajectory. S.L.

N83-16528*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ANALYSIS OF A MIL-L-27502 LUBRICANT FROM A GAS-TURBINE ENGINE TEST BY SIZE-EXCLUSION CHROMATOGRAPHY

W. R. JONES, JR. and W. MORALES Jan. 1983 15 p refs (NASA-TP-2063; E-1075; NAS 1.60:2063) Avail: NTIS HC A02/MF A01 CSCL 11H

Size exclusion chromatography was used to determine the chemical degradation of MIL-L-27502 oil samples from a gas turbine engine test run at a bulk oil temperature of 216 C. Results revealed a progressive loss of primary ester and additive depletion and the formation of higher molecular weight products with time. The high molecular weight products absorbed strongly in the ultraviolet indicating the presence of chromophoric groups. S.L.

N83-16531# Pacific Northwest Lab., Richland, Wash.

SPUTTERED CERAMIC COATINGS AND SEALING LAYERS

J. T. PRATER, J. W. PATTEN, D. D. HAYS, and R. W. MOSS Oct. 1981 15 p refs Presented at the 2nd Conf. on Advan. Mater. for Alternative fuel Capable Heat Eng., Monterey, Calif., 24 Aug. 1981

(Contract DE-AC06-76RL-01830)

(DE82-005225; PNL-SA-9961; CONF-810885-3) Avail: NTIS HC A02/MF A01

Progress on the development of hybrid ceramic/metal sputter deposited coatings which are designed to be adherent to metal substrates in gas turbine hot sections is reported. The ceramic materials investigated are $ZrO_2 + 20\% Y_2O_3$ and pure Al_2O_3 . The metal is CoCrAlY. In general, a CoCrAlY layer is sputter deposited first. The composition is then graded so that the ceramic content increases towards the coating surface. This transition zone has a segmented (columnar) structure, and varies in thickness. In some cases, the coating surface still contained some CoCrAlY. Heat treatments were conducted on these deposits in an effort to provide a continuous metal (minority phase) matrix along the ceramic grain boundaries. For other deposits, the grading is continued until no metal is present, and a thick layer of pure ceramic is deposited over the graded material. Preliminary thermal cycle results, microstructural characterization, and composition profile data are presented. DOE

N83-16536# Centre Technique des Industries Mecaniques, St. Etienne (France).

EVALUATION OF LUBRICANTS FOR AIR COMPRESSORS Final Report

N. ALLIER and J. G. SCHAMELHOUT Sep. 1979 315 p refs Transl. into ENGLISH of mono. "Des Lubricants Pour Compresseurs d'Air" Original language document was announced as N82-10408/4 (PB82-259003; CETIM-12-E-12-0) Avail: NTIS HC A14/MF A01 CSCL 11H

The document provides the results of a detailed study of methods for evaluating both mineral and synthetic lubricants for use with reciprocating and rotary air compressors. The main concern with respect to reciprocating air compressors is that the lubricants should be adequately evaluated from the points of view of safety toward man and the environment, and safety toward the equipment. In addition to describing the studies and their results, the document discusses the basics of lubrication and its application to air compressors; the formation of carbon deposits and the rise of fire in reciprocating compressors; standards relating to lubricants for air compressors; and assessment of air compressors available in the world market. GRA

N83-16543*# California Univ., Berkeley. Dept. of Chemical Engineering.

VISCOMETRIC AND MISTING PROPERTIES OF POLYMER-MODIFIED FUEL Final Technical Report, 1 Nov. 1981 - 30 Sep. 1982

E. A. GRENS, II and M. C. WILLIAMS 1982 9 p refs (Contract NCC2-163)

(NASA-CR-169750; NAS 1.26:169750) Avail: NTIS HC A02/MF A01 CSCL 21D

Solutions of polyisobutylenes L160, L200, B200, and B230 in Jet-A were prepared at concentrations up to 3000 ppm. These polymers have molecular weights in the range 5 to 9 x 1,00,000 and have previously been shown to induce anti-misting properties in Jet-A. In connection with the pumpability of such solutions, especially at low temperatures, the shear viscosity, eta, of these solutions was measured at temperatures 25 C, 0 C, and -25 C. Concentration-dependence of eta was very similar for all four polymer solutes, the increase of eta(c) at 3000 ppm being roughly four-fold (relative to Jet-A) for the L-series and five-fold for the B-series. This behavior prevailed at all temperatures, and there was no evidence of phase separation or other chemical instability at -25 C at any concentration. In the more practical c-range for anti-misting applications, say within 1000 ppm, the increase of eta(c) was only twofold. Author

N83-16553# Institute of Gas Technology, Chicago, Ill.

COAL GASIFICATION FOR STATIONARY GAS-TURBINE APPLICATIONS

A. GOYAL, D. K. FLEMING, and W. G. BAIR 1981 25 p refs Presented at the ASTM Symp. on Alternative Fuels and Future Fuels Specifications for Stationary Gas Turbine Appl., Phoenix, Ariz., 9-10 Dec. 1981

(DE82-902135; CONF-811220-1) Avail: NTIS HC A02/MF A01

Various types of coal gasification processes which are available commercially or are in the developmental stages are reviewed. The properties of the gaseous fuels produced by different gasifiers are discussed. Gas clean-up systems, adaptable for turbine applications, are presented, and factors influencing process selection are outlined. DOE

N83-17597*# Rensselaer Polytechnic Inst., Troy, N. Y. School of Engineering.

COMPOSITE STRUCTURAL MATERIALS Semiannual Progress Report, 30 Apr. - 30 Sep. 1982

G. S. ANSELL, R. G. LOEWY, and S. E. WIBERLEY Dec. 1982 167 p refs

(Contract NGL-33-018-003)

(NASA-CR-169859; NAS 1.26:169859; SAR-43) Avail: NTIS HC A08/MF A01 CSCL 11D

The promise of filamentary composite materials, whose development may be considered as entering its second generation, continues to generate intense interest and applications activity. Fiber reinforced composite materials offer substantially improved performance and potentially lower costs for aerospace hardware. Much progress has been achieved since the initial developments in the mid 1960's. Rather limited applications to primary aircraft structure have been made, however, mainly in a material-substitution mode on military aircraft, except for a few experiments currently underway on large passenger airplanes in commercial operation. To fulfill the promise of composite materials completely requires a strong technology base. NASA and AFOSR recognize the present state of the art to be such that to fully exploit composites in sophisticated aerospace structures, the technology base must be improved. This, in turn, calls for expanding fundamental knowledge and the means by which it can be successfully applied in design and manufacture. L.F.M.

N83-17600*# Lockheed-Georgia Co., Marietta.
PROGRAM FOR ESTABLISHING LONG-TIME FLIGHT SERVICE PERFORMANCE OF COMPOSITE MATERIALS IN THE CENTER WING STRUCTURE OF C-130 AIRCRAFT. PHASE 5: FLIGHT SERVICE AND INSPECTION Final Report

J. A. KIZER Oct. 1981 36 p refs
 (Contract NAS1-11100)
 (NASA-CR-165770; NAS 1.26:165770; LG81340198) Avail:
 NTIS HC A03/MF A01 CSCL 11D

Inspections of the C-130 composite-reinforced center wings were conducted over the flight service monitoring period of more than six years. Twelve inspections were conducted on each of the two C-130H airplanes having composite reinforced center wing boxes. Each inspection consisted of visual and ultrasonic inspection of the selective boron-epoxy reinforced center wings which included the inspection of the boron-epoxy laminates and the boron-epoxy reinforcement/aluminum structure adhesive bondlines. During the flight service monitoring period, the two C-130H aircraft accumulated more than 10,000 flight hours and no defects were detected in the inspections over this period. The successful performance of the C-130H aircraft with composite-reinforced center wings allowed the transfer of the responsibilities of inspecting and maintaining these two aircraft to the U. S. Air Force. Author

N83-17609# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

PRACTICAL CONSIDERATIONS OF DESIGN, FABRICATION AND TESTS FOR COMPOSITE MATERIALS

Sep. 1982 198 p refs Lectures held in Oporto, Portugal, 11-12 Oct. 1982, in London, 14-15 Oct. 1982 and in Ankara, 18-19 Oct. 1982
 (AGARD-LS-124; ISBN-92-835-1436-X) Avail: NTIS HC A09/MF /01

Fiber composites used as aircraft construction materials are discussed. Emphasis is placed on the mechanical properties of the composites. Failure analysis, structural integrity, fatigue damage, micromechanical models, and structural analysis are discussed.

N83-17610# Bath Univ. (England). School of Materials Science.

THE NATURE OF FIBRE COMPOSITE MATERIALS

B. HARRIS In AGARD Pract. Considerations of Design, Fabric. and Tests for Composite Mater. 5 p Sep. 1982 refs
 Avail: NTIS HC A09/MF A01

The physical and mechanical characteristics of the practical fiber composites that are most prominently of interest to structural and aeronautical engineers are discussed. Some of their applications in the aerospace field are discussed. Various composite materials are compared in terms of strength. The functions of the matrix are discussed. R.J.F.

N83-17618# Royal Aircraft Establishment, Farnborough (England).

THE ELECTRICAL PROPERTIES OF CARBON FIBRE COMPOSITES

J. M. THOMSON In AGARD Pract. Considerations of Design, Fabric. and Tests for Composite Mater. 15 p Sep. 1982 refs
 Avail: NTIS HC A09/MF A01

The essential electrical difference between a carbon fiber composite and conventional metal alloys is that its resistivity is about three orders higher. This fact affects the electromagnetic compatibility (EMC) of the airframes, its performance as an antenna ground plane, the provision of power and of Earth returns and radar cross-section. Research on the electrical properties of carbon fiber composites under these headings is reviewed and the importance of good bonding and jointing emphasized. The major problem areas (which tend to occur at frequencies less than 30 MHz) are outlined, as are those areas where problems are likely to be minor. Although electrical research lags structures and materials research by some 10 to 15 years, nonetheless sufficient

work has been done for some interim design recommendations to be formulated, and these are discussed. Author

N83-17620# Grumman Aerospace Corp., Bethpage, N.Y. Automated Manufacturing Systems Development Section.

MANUFACTURING PROCESSES FOR AERONAUTICAL STRUCTURES

R. HADCOCK and J. HUBER In AGARD Pract. Considerations of Design, Fabric. and Tests for Composite Mater. 13 p Sep. 1982 refs

Avail: NTIS HC A09/MF A01

Current manufacturing processes for fabricating composite aeronautical structures are reviewed. Laminating, autoclave curing, hot press molding, injection molding, pultrusion, drilling and trimming are discussed for three principal composite materials - boron/epoxy, graphite/epoxy and Kevlar/epoxy. The unique manufacturing operations associated with each type of material up to and including the curing process are emphasized. The effect of various tooling concepts and materials on production rates and costs is discussed. Unique processing equipment developed for the several composite materials forms available is described.

E.A.K.

N83-17621# Grumman Aerospace Corp., Bethpage, N.Y. Automated Manufacturing Systems Development Section.

SPECIFIC EXAMPLES OF AEROSPACE APPLICATIONS OF COMPOSITES

R. HADCOCK and J. HUBER In AGARD Pract. Considerations of Design, Fabric. and Tests for Composite Mater. 13 p Sep. 1982 refs

Avail: NTIS HC A09/MF A01

The state of the art for the use of composites in both prototype and production, structural and nonstructural aerospace components is reviewed. Historic material usage trends for both commercial and military applications are presented. The applications show the evolution of composite components from relatively simple parts to the current, large and complex structures. The use of composite materials in the new generation of commercial transport aircraft is presented. Specific areas of application, such as spoilers, flaps and fairings, are discussed for impact on part weight, type of construction, and material selection factors. Selected, major composite programs for military aircraft, are reviewed. Composite materials used in these aircraft are analyzed with respect to the percent of the structural weight, type of material utilized, areas of application, type of construction and special manufacturing processes used in production. The test procedures utilized to evaluate composite structures are reviewed.

E.A.K.

N83-17683*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COATING WITH OVERLAY METALLIC-CERMET ALLOY SYSTEMS Patent Application

M. A. GEDWILL, S. R. LEVINE, and T. K. GLASGOW, inventors (to NASA) 7 Jan. 1983 12 p
 (NASA-CASE-LEW-13639-2; US-PATENT-APPL-SN-456460)
 Avail: NTIS HC A02/MF A01 CSCL 11F

A base layer of an oxide dispersed, metallic alloy (cermet) is arc plasma sprayed onto a substrate, such as a turbine blade, vane, or the like, which is subjected to high temperature use. A top layer of an oxidation, hot corrosion, erosion resistant alloy of nickel, cobalt, or iron is then arc plasma sprayed onto the base layer. A heat treatment is used to improve the bonding. The base layer serves as an inhibitor to interdiffusion between the protective top layer and the substrate. Otherwise, the 10 protective top layer would rapidly interact detrimentally with the substrate and degrade by spalling of the protective oxides formed on the outer surface at elevated temperatures. NASA

11 CHEMISTRY AND MATERIALS

N83-17716# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

EROSION OF PROTECTIVE COMPRESSOR COATINGS

H. J. KOLKMAN Dec. 1981 23 p refs Submitted for publication Sponsored in part by the Royal Netherlands Airforce (NLR-MP-87067-U) Avail: NTIS HC A02/MF A01

Erosion prone compressor components coatings of gas turbines which are often protected against corrosion by metallic coatings are discussed. These thin coatings however are prone to erosion. Two coatings applied to compressor vanes of a jet engine were tested for erosion under simulated service conditions. Some tests on coated coupons were also performed. The tests on the vanes gave the most reliable results. The erosion resistance of the two coatings was more or less equal. E.A.K.

N83-17728*# United Technologies Research Center, East Hartford, Conn.

EXPERIMENTAL STUDY OF THE THERMAL STABILITY OF HYDROCARBON FUELS

P. J. MARTENEY, M. B. COLKET, and A. VRANOS Dec. 1982 70 p refs

(Contract NAS3-22511)

(NASA-CR-168027; NAS 1.26:168027; R82-955319-20) Avail:

NTIS HC A04/MF A01 CSCL 21D

The thermal stability of two hydrocarbon fuels (premium diesel and regular diesel) was determined in a flow reactor under conditions representing operation of an aircraft gas turbine engine. Temperature was varied from 300 to 750 F (422 to 672 K) for fuel flows of 2.84 to 56.8 liters/hr (corresponding to 6.84×0.00010 to 1.63×0.010 kg/sec for regular diesel fuel and 6.55×0.00010 to 1.37×0.010 kg/sec for premium diesel fuel); test times varied between 1 and 8 hr. The rate of deposition was obtained through measurement of weight gained by metal discs fixed along the channel wall. The rate of deposit formation is best correlated by an Arrhenius expression. The sample discs in the flow reactor were varied among stainless steel, aluminum and brass; fuels were doped with quinoline, indole, and benzoyl peroxide to yield nitrogen or oxygen concentrations of approximately 1000 ppm. The most substantial change in rate was an increase in deposits for brass discs; other disc materials or the additives caused only small perturbations. Tests were also conducted in a static reactor at temperatures of 300 to 800 F for times of 30 min to 2 1/2 hr. Much smaller deposition was found, indicating the importance of fluid transport in the mechanism. Author

12

ENGINEERING

Includes engineering (general); communications; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

A83-19674#

UNBALANCE RESPONSE ANALYSIS OF A COMPLETE TURBOMACHINE

N. KLOMPAS (General Electric Co., Gas Turbine Div., Schenectady, NY) ASME, Transactions, Journal of Engineering for Power, vol. 105, Jan. 1983, p. 184-191. refs

A new method is derived to calculate unbalance response of a complete turbomachine, including mount asymmetry, disk flexibility, and fluid-film bearing anisotropy by utilizing conventionally obtained stiffness coefficients for the rotor and stator. Formulation through the coordinates whirl and whip is in real variables with only eight equations per bearing. Whereas the stator is usually ignored, sample analysis illustrates possible strong influence of casing flexibility. Coordinate transformations to enhance visualization and verification of the solution are shown. (Author)

A83-19711#

USAF GROUND FIBER OPTIC DEVELOPMENT PROGRAM

P. SIERAK (USAF, Rome Air Development Center, Griffiss AFB, NY) and B. WARREN (USAF, Washington, DC) In: NTC '81; National Telecommunications Conference, New Orleans, LA, November 29-December 3, 1981, Record. Volume 2. New York, Institute of Electrical and Electronics Engineers, Inc., 1981, p. C1.3.1-C1.3.6.

Fiber optic development programs of the Air Force are related to applications in the areas of tactical communications, multiterminal communications, and the development of militarized standard transceivers. The Tactical Air Control System (TACS) provides the Air Force component commander with the means to plan and direct tactical air operations, and to coordinate joint operations with other services. A description of the program concerned with tactical fiber optic communications is presented, taking into account this technology in relation to the Air Support Operations Center (ASOC) and the Control and Reporting Center (CRC). Attention is given to CX-4566 26 pair cable characteristics, major ASOC radio data transfer requirements, consolidated TRC-97 link analysis, TPS-43 fiber optic Triax replacement analysis, aspects of distributed data processing, questions of militarized standard transceiver development, and efficient multiplexing techniques for fiber optics. G.R.

A83-19804#

COMPUTER-ENHANCED ANALYSIS OF A JET IN A CROSS STREAM

J. W. TRISCHKA (Syracuse University, Syracuse, NY) and N. J. BIRKENHEUER (National Center for Atmospheric Research, Boulder, CO) AIAA Journal, vol. 21, Feb. 1983, p. 174, 175.

(Previously announced in STAR as N82-29555)

A83-19821#

FLUTTER OF ORTHOTROPIC PANELS IN SUPERSONIC FLOW USING AFFINE TRANSFORMATIONS

G. A. OYIBO (Fairchild Republic Co., Farmingdale, NY) AIAA Journal, vol. 21, Feb. 1983, p. 283-289. refs

The flutter problem of rectangular simply supported orthotropic panels subjected to supersonic flow over one surface is investigated using affine transformations. A comprehensive solution, in which the isotropic panels solution is a subset, is obtained for this problem with the help of certain defined characteristic and bounded quantities. This method of analysis shows how the aerodynamic and the elastic forces interact to produce the panel flutter phenomenon. It is found that the aerodynamic strip (Ackeret) theory and the lifting surface theory produce comparable results. Thus, the aerodynamic strip theory, the simpler of the two theories, is used to determine the complete stability boundaries for both flat and buckled panels. N.B.

A83-20288#

NONLINEAR FORCED OSCILLATIONS OF A ROTATING SHAFT CARRYING AN UNSYMMETRICAL ROTOR AT THE MAJOR CRITICAL SPEED

T. YAMAMOTO, Y. ISHIDA, T. IKEDA, and M. YAMAMOTO (Nagoya University, Nagoya, Japan) JSME, Bulletin, vol. 25, Dec. 1982, p. 1969-1976. refs

This paper deals with the motion of an unsymmetrical rotor possessing nonlinear spring characteristics, due to the angular clearance of a single-row deep groove ball bearing, in the vicinity of the major critical speed. When this system is operated near the major critical speed, no unstable vibration occurs, but peculiar resonance curves of hard spring type are obtained which have three stable amplitudes at most against the rotating speed. The resonance curves are classified into two types. They are the cases where the jump phenomenon appears once or twice during deceleration of the rotating speed. It is clarified that the type of the resonance curve depends on the angular position of rotor unbalance. (Author)

A83-20379

CERTAIN EFFECTS AND PARADOXES IN AERODYNAMICS AND HYDRAULICS [NEKOTORYE EFFEKTY I PARADOKSY V AERODINAMIKE I GIDRAVLIKE]

I. E. IDELCHIK Moscow, Izdatel'stvo Mashinostroenie, 1982. 97 p. In Russian. refs

Information is presented on certain effects and paradoxes associated with fluid flow (at least 25 such effects are considered in some detail). Attention is given to such phenomena as friction drag in straight pipes with stabilized flow, the effect of heavy particles on the structure of free jets, the cellular structure of flow past a cylinder, flow through a single two-dimensional cascade, and flow in complex pipelines. B.J.

A83-20384

LASERS IN AVIATION [LAZERY V AVIATSII]

I. N. GONCHAROV, V. N. DEZHIN, V. P. KUTAKHOV, A. V. PETUKHOV, V. M. SIDORIN, and I. M. SUKHAR Moscow, Voenizdat, 1982. 160 p. In Russian. refs

The way in which lasers are being incorporated into the military aircraft of the United States and the countries of Western Europe is discussed. Descriptions are given of laser weapons-guiding systems (including ranger finders and systems for target illumination), laser systems for navigation and flight-safety assurance (gyroscopes, velocity gauges, altimeters, systems providing meteorological data, proximity warning systems), and laser systems for air reconnaissance, communications, and control. Attention is also given to the Glissada laser guide path system, developed in the USSR. The physics of the systems is emphasized in the description and the principles underlying the operation of a laser are discussed in the introduction. C.R.

A83-20500

ELECTRICAL DISCHARGE MACHINING OF ALUMINUM HONEYCOMB CORE

K. L. LAND (Douglas Aircraft Co., Long Beach, CA) In: National SAMPE Symposium and Exhibition, 27th, San Diego, CA, May 4-6, 1982, Proceedings. Azusa, CA, Society for the Advancement of Material and Process Engineering, 1982, p. 1044-1059.

Electrical discharge machining (EDM), a process that removes metal from a workpiece by bombarding it with high-energy sparks of short duration and controlled magnitude (amplitude), is discussed. The sparks occur at a controlled rate ranging from 400 to 400,000 per second. The electrode (tool) and the workpiece (aluminum honeycomb) are not in physical contact. Metal is removed by the combined effect of the heat energy of the spark discharged and the collapse of the hydrogen 'gas bubble'. To create a single discharge, voltage is built up gradually between the electrode and the workpiece. As this happens, electrons pile up on the surface of the electrode until the stresses become so great that billions of electrons crash through the dielectric barrier, speeding toward the workpiece at nearly the speed of light. The voltage at which the discharge occurs is controlled by the strength of the particular dielectric solution and the space between the electrode and the workpiece. C.R.

A83-20962

A RAPID METHOD FOR DETERMINING THE INITIAL BOILING POINT AND THE SATURATED-VAPOR PRESSURE OF PETROLEUM PRODUCTS [EKSPRESS-METOD OPREDELENIYA TEMPERATURY NACHALA KIPENIYA I DAVLENIYA NASYSHCHENNYKH PAROV NEFTEPRODUKTOV]

A. N. SOLOVEV, B. A. MALOV, and B. F. LAKHIN (Kievskii Institut Inzhenerov Grazhdanskoi Aviatsii, Kiev, Ukrainian SSR) Promyshlennaya Teplotekhnika, vol. 5, Jan.-Feb. 1983, p. 68-70. In Russian.

A rapid method is proposed whereby the initial boiling point is measured by heating a sample in a cell of a constant specific heat, and the saturated-vapor pressure is calculated from an expression relating the pressure to the initial boiling point. The design of a corresponding gauge and a measurement routine incorporating this method are described. The initial boiling point and the saturated-vapor pressure of various petroleum products

can be determined using the method proposed here to within 1°C and 3%, respectively. V.L.

A83-21007#

THEORETICAL STIFFNESS MATRIX CORRECTION BY USING STATIC TEST RESULTS

Z. SHEENA, A. ZALMANOVICH, and A. UNGER (Israel Aircraft Industries, Ltd., Lod, Israel) In: Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers. Haifa, Technion - Israel Institute of Technology, 1982, p. 48-56. refs

A closed form minimization method for static structure tests is described which uses measured deflections due to a known loading as constraints in the correction process of the stiffness or flexibility matrix. The correction method is applied to the problem of vibrations of a 45 degree delta wing, and a significant improvement in the theoretical model is attained: three loading cases are found to be enough to make an appreciable improvement on the theoretical stiffness matrix. The effect of the weighting matrix on the results is investigated, and it is found that a weighting matrix equal to the original stiffness matrix gives better results than a weighting matrix equal to unity. C.D.

A83-21348

AUTOMATED MACHINING OF TURBINE BLADES BY ROLLS-ROYCE

Aircraft Engineering, vol. 55, Jan 1983, p. 7-9.

An automated production line for machining turbine blades for aircraft engines is described. The line incorporates robots and uses creep-feed grinding machines, which have reduced typical grinding cycle times from 6 min to 45 sec. The line is used for a number of machining operations on vacuum-cast blades. An encapsulation technique is used in casting a zinc-alloy location feature around the airfoil section of each turbine blade at the start of the line. Then a conveyor takes each blade to a series of cells, each of which incorporates a programmable robot for handling blades, two grinding machines, and automatic capsule cleaning and inspection facilities. There are seven cells in all, including one kept in reserve. The encapsulated blades move along the conveyor system and are removed at the machining cells; at each cell two grinding operations are completed. Quality and production are controlled by a central computer. The line is designed to machine cast blades, blades produced by the directional solidification technique, and blades consisting of a single crystal of metal. C.R.

A83-21448

FINITE ELEMENT STRENGTH ANALYSIS OF ROTATING SHELL-PLATE STRUCTURES

Z. DZYGADLO and I. NOWOTARSKI Journal of Technical Physics, vol. 22, no. 3, 1981, p. 243-257. refs

The paper considers the use of finite strength analysis to study of systems composed of large numbers of disk and shell elements, such as the rotating structures of turbines and compressors of aircraft power plants. Mathematical models are proposed for bolted and forced-in joints situated between particular elements of the system, which is assumed to be in a nonhomogeneous temperature field and subject to a variety of loads. It is assumed that the thickness and external loads vary linearly along the generatrix as a function of the temperature, and that the effects of geometrical nonlinearity on the stress-strain state of the object are taken into account. A set of equations is obtained which can be used as the basis of a program for finite element analysis of the considered structures. M.I.I.

A83-21459

HIGH TEMPERATURE STABILITY OF PACK ALUMINIDE COATINGS ON IN38LC

S. P. COOPER and A. STRANG (GEC Turbine Generators, Ltd., Central Metallurgical Laboratories, Whetstone, Leics., England) In: High temperature alloys for gas turbines 1982; Proceedings of the Conference, Liege, Belgium, October 4-6, 1982. Dordrecht, D. Reidel Publishing Co., 1982, p. 249-260. refs

The formation of typical commercial pack aluminide coatings is described, and the behavior of a specific aluminide coating, designated H1 15, on an IN738LC substrate is examined under conditions of prolonged high-temperature exposure. The microstructural changes occurring at 750 and 850 C over test durations up to 30,000 hours are illustrated and details of the changes discussed. The behavior of the more recently developed platinum aluminide coatings under similar conditions is then presented for comparison. It is shown that the platinum-modified coatings have the more stable beta layer and appear to be more suitable for extended use in industrial gas turbines. V.L.

A83-21461

FATIGUE AND CREEP CONSIDERATIONS IN THE DESIGN OF TURBINE COMPONENTS

P. SENECHAL (SNECMA, Moissy-Cramayel, Seine-et-Marne, France) In: High temperature alloys for gas turbines 1982; Proceedings of the Conference, Liege, Belgium, October 4-6, 1982. Dordrecht, D. Reidel Publishing Co., 1982, p. 273-290.

Test techniques, calculation methods, and associated criteria for the prediction of low-cycle fatigue and creep life limits of the disks and blades (uncooled and cooled) of aircraft gas-turbine engines are examined. The discussion covers engine operating conditions for both commercial and combat aircraft, designing for low-cycle fatigue and creep, material characterization, creep tests, crack initiation tests, and crack propagation tests. The numerical methods examined include finite element methods and the method of boundary integral equations. Examples of disk and cooled-blade life predictions are given. V.L.

A83-21654

ANALYSIS AND REPAIR OF FLAWS IN THICK STRUCTURES

R. JONES and R. J. CALLINAN (Department of Defence, Aeronautical Research Laboratories, Melbourne, Australia) In: Advances in fracture research; Proceedings of the Fifth International Conference on Fracture, Cannes, France, March 29-April 3, 1981. Volume 1. Oxford, Pergamon Press, 1982, p. 23-32. refs

This paper develops a finite element method for determining the stress intensity factors along the edge of a crack in an arbitrary three-dimensional body. A special element is placed around the crack front and in each special element the stresses and displacements are derived using the asymptotic nature of the stress and displacement fields near a crack tip. As illustrative examples the problems of a semicircular surface flaw and an internal penny shaped crack are first considered. In each case the computed values of the stress intensity factors are in excellent agreement with known analytical results. The repair of the surface flaw is then considered using a bonded overlay of composite material, and the effect of the overlay on the stress intensity factors is discussed. (Author)

A83-21796

PROGRESS IN THE PRACTICAL APPLICATIONS OF FRACTURE MECHANICS

H. T. CORTEN (Illinois, University, Urbana, IL) In: Advances in fracture research; Proceedings of the Fifth International Conference on Fracture, Cannes, France, March 29-April 3, 1981. Volume 6. Oxford, Pergamon Press, 1982, p. 2649-2668. refs

Intended for the nonspecialist, this introduction to fracture mechanics focuses upon a few important concepts and illustrates their use in three application areas: damage tolerance requirements for aircraft structures, toughness requirements for bridges and heat up and cool down schedule and evaluation of inservice NDE indications for nuclear pressure vessels. (Author)

A83-21799

PRACTICAL APPLICATION OF FRACTURE MECHANICS

A. PELLISSIER TANON and E. SOMMER In: Advances in fracture research; Proceedings of the Fifth International Conference on Fracture, Cannes, France, March 29-April 3, 1981. Volume 6. Oxford, Pergamon Press, 1982, p. 2705-2708.

The subject matters of a series of papers on fracture mechanics are summarized. The general topics include: surface cracks, failure criteria for components, initiation and growth of fatigue cracks, cracking from surface contact loading, fracture resistance of welds, fatigue resistance of welded joints, reliability and probabilistic analysis. Individual papers discuss: reasons for natural cracks geometries and non-self-similar crack growth; the applicability and limitations of existing fracture mechanics; theoretical considerations and case studies on crack formation in notched members; mixed-mode LEFM analysis for surface spalling; early crack initiation caused by the fretting process. Also considered are: embrittlement in heat-affected zones; the effects of residual stresses on fatigue cracking; assessment of the safety of fatigue design rules; the use of reliability and probabilistic analysis in the aircraft and nuclear industries. C.D.

A83-22027#

THE DEVELOPMENT OF STANDARDS FOR THE COMMON ICAO DATA INTERCHANGE NETWORK /CIDIN/

W. T. MALONEY (Department of Transport, Planning, Research and Development Branch, Melbourne, Australia) Journal of Electrical and Electronics Engineering, Australia, vol. 2, Dec. 1982, p. 234-239.

This paper describes recent work by the International Civil Aviation Organisation (ICAO) to develop standards applicable to a modern data network to serve the aeronautical community. The ICAO work is discussed in relation to the seven layer architecture for open systems interconnection that has been identified by ISO and explains the transport service functions considered to date (Levels 1-4). The requirement for more modern facilities is reviewed in the light of evolution of air traffic facilities from manual to more automated type in which teleprocessing will become increasingly important. Compatibility with international standards and application of public data networks in the private aeronautical environment is discussed. An outline is presented of the domestic data interchange plan for aeronautical data, showing the evolution of the data network and provision of aeronautical data bases. Finally, an indication of the likely impact of satellite bearers on network topology is given. (Author)

A83-22151#

EQUIVALENT G/E OF HELICOPTER ROTOR BLADES

A. ROSEN (Technion - Israel Institute of Technology, Haifa, Israel) AIAA Journal, vol. 21, Mar. 1983, p. 478, 479; Author's Reply, p. 479, 480. refs

Attention is given to the contention by Hodges (1980, 1981) that averaging leads to effective values of G/E that may differ from those encountered in isotropic structures by one or more orders of magnitude. Using existing helicopter blades, it is shown that this contention is in error and that the typical equivalent G/E of modern helicopter blades is very similar to that of isotropic materials and is not by any means different by one or more orders of magnitude. It is pointed out that many of the results that were obtained for isotropic beams may also be applied to rotor blades. Noting that there are certain limitations to using the concept of equivalent G/E for investigating the behavior of rotor blades, it is considered preferable to treat the blades as beams by considering equivalent beam properties that may be validated by experiments. C.R.

A83-22318**ISRAEL CONFERENCE ON MECHANICAL ENGINEERING, 16TH, TECHNION - ISRAEL INSTITUTE OF TECHNOLOGY, HAIFA, ISRAEL, JULY 13, 14, 1982, PROCEEDINGS**

Conference sponsored by the Technion - Israel Institute of Technology, University of Negev, Tel Aviv University, and Association of Engineers and Architects in Israel. Israel Journal of Technology, vol. 20, no. 1-2, 1982. 96 p.

The present conference on topics in mechanical engineering considers advances in high speed rolling element bearings, the dynamic analysis of mechanical concentrators and nonuniform elements through modulation functions, problems associated with carbon oxidation, influence coefficients for variable geometry free gas turbines, and the thermoelastohydrodynamic analysis of an oil pumping ring seal. Also discussed are the detailed analysis of the effects of inertia on the filtration efficiency of granular bed filters, the use of gas dynamics to improve reciprocating engine performance, the optimization of vehicle powertrain performance by means of simulations, and the laboratory modeling of in situ retorting by steam injection and cracking of shale oil liquids

O.C.

A83-22319* National Aeronautics and Space Administration
Lewis Research Center, Cleveland, Ohio.

ADVANCES IN HIGH-SPEED ROLLING-ELEMENT BEARINGS

E. V. ZARETSKY (NASA, Lewis Research Center, Cleveland, OH) (Israel Conference on Mechanical Engineering, 16th, Haifa, Israel, July 13, 14, 1982.) Israel Journal of Technology, vol. 20, no. 1-2, 1982, p. 3-16 refs

The research program begun by NASA in 1959 in order to investigate the projected temperature and speed requirements of large bore ball and roller bearings was expanded in the 1970s to include tapered roller and small bore bearings. In the course of the program, bearing speeds as high as 3 million DN and 2.4 million DN, respectively, were achieved for ball and tapered roller bearings with fatigue lives exceeding those common in commercial aircraft. The computer analysis of rolling element bearings operation have yielded reasonably accurate performance predictions for speeds up to 3 million DN. It was found that under-race bearing lubrication improved operational performance over that achieved with conventional jet lubrication methods at high bearing speeds.

O.C.

A83-22410**EDDY CURRENT IMPEDANCE PLANE ANALYSIS**

D. J. HAGEMAIER (Douglas Aircraft Co., Long Beach, CA) (Eurotest Conference on New Trends in Non-Destructive Testing, Brussels, Belgium, Mar. 24-26, 1982) Materials Evaluation, vol. 41, Feb. 1983, p. 211-218.

The paper discusses the application of eddy current impedance plane analysis for determining variations in material conditions such as conductivity, liftoff and edge effects, cracks, material separation and spacing, permeability, specimen thinning, and plating thickness. Changes in these conditions in the specimen under investigation can be determined by measuring the impedance changes in a test coil caused by eddy current induced in an electrically conductive material. Thus unique loci or phasor plots on the impedance plane at a particular frequency are established for any particular condition, material, and frequency. The results obtained for each set of conditions are discussed and it is found that in magnetic and nonmagnetic materials the loci values are displaced logarithmically. The conductivity in the same kind of materials varies with the test frequency, and so does the magnetic permeability. Metal thinning and material spacing and separation exhibit exponential plots, while plating thickness in nonmagnetic materials and conductive coating on steel show logarithmic displacement on the impedance plane.

M.I.I.

A83-22596**ANALYSIS OF TARGET COVERAGE FOR AN UNSTABILIZED 35 MM PANORAMIC STRIKE CAMERA**

J. T. SHARPSTEEN (Perkin-Elmer Corp., Aerospace Div., Pomona, CA) In: Airborne reconnaissance V; Proceedings of the Seminar, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1981, p. 199-211.

A method of target coverage analysis has been developed to meet a need for simple and rapid comparisons of the orientations of 35-mm, 180-deg panoramic cameras mounted on strike aircraft. A comparative analysis of camera orientations is made by relating ground coverage in mathematical form to various conditions of flight. Flight paths and bomb trajectories are also expressed mathematically. Comparisons of the mounting methods are obtained by synthesis of these mathematical relations. The general comparison method developed uses a simple paper and pencil analysis to obtain the mathematical relations, and transparent plastic overlays to perform the synthesis. A graphic solution is obtained where conditions can be easily altered to determine their effects on the final result. Examples are presented for the type KA101A (Minipan) camera mounted in the A-10 aircraft. The method can be also used for a more sophisticated computer-based analytical package for predicting target coverage.

V.L.

A83-22832**CALLIGRAPHIC/RASTER COLOR DISPLAY FOR SIMULATION**

J. A. MAYS (Systems Research Laboratories, Inc., Dayton, OH) In: Visual simulation and image realism II; Proceedings of the Conference, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 16-22.

Large screen color CRT displays using computer-generated imagery for aircraft pilot training simulation are examined. A shadow mask color display capable of performance in either raster scan or calligraphic formats is described. Raster scans alone have been observed to lack sufficient brightness, geometric accuracy, and scan stability when applied to wide field-of-view, multiple window visual projections due to the short dwell time at each pixel. A higher resolution system was devised by including an external analog input signal to control the CRT spot size, and the stroke (calligraphic) mode, which could be written during the blanking intervals to account for background images. A dynamic convergence correction was employed to ameliorate the geometrical distortions due to a 120 radial deg displacement of the three scan guns. A division of the image area into zones which were individually corrected produced precision convergence. Other factors, such as dynamic raster shaping and deflection are discussed.

M.S.K.

A83-22834**TARGET TV PROJECTOR WITH DYNAMIC RASTER SHAPING FOR USE IN DOME SIMULATORS**

R. E. HOLMES (Systems Research Laboratories, Inc., Dayton, OH) In: Visual simulation and image realism II; Proceedings of the Conference, San Diego, CA, August 27, 28, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 29-33.

Image projection techniques employed with the U.S. Navy 2 E7 training device are described, with an emphasis on F/A-18 applications. Two 40 ft diam. projection domes each house a simulated cockpit environment. The individual cockpits are equipped with three-view screens filling a 120 deg segment of the domes and displaying a digitally-generated image of the sky and ground environment. The image is predistorted to account for any distortions which might occur due to the projection angle. The predistortion algorithms function by redirecting the horizontal and vertical sweep signals in a series of linear and nonlinear analog expressions. Attention has been given to position, size, linearity, trapezoidal shape, pincushion/barrel shape, curvature, rotation, and orthogonality. Pilots in the simulators can enter combat with each other or both can fight the computer. Linear current feedback

amplifiers are used with both the horizontal and vertical deflection amplifiers to assure continuous raster rotation. M.S.K.

A83-22883

ELECTRO-OPTICAL CALIBRATION CONSIDERATIONS AT INTERMEDIATE MAINTENANCE LEVELS

V. J. STAKUN and P. E. SEELEY (RCA, Automated Systems, Burlington, MA) In: Contemporary infrared standards and calibration; Proceedings of the Meeting, San Diego, CA, August 25, 26, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 79-89.

Factory and field calibration procedures for the infrared stimulus and measurement devices are discussed in the context of the Automatic Test Equipment (ATE) developed for the Army Land Combat Support System. Calibration requirements for the electro-optic test equipment are illustrated by describing the functions and performance specifications of the ATE components. These include a detector adapter, a source adapter, a radiometer, a vidicon test source, an intensity test source, and a dedicated radiometer used to calibrate a field-test collimator unit. Finally, some future calibration requirements are discussed. V.L.

A83-22886

CALIBRATION SUPPORT OF THE AN/AAM-60 COMMON FORWARD-LOOKING INFRARED /FLIR/ TEST BENCH

F. SCHWEIZER (U S. Navy Metrology Engineering Center, Pomona, CA) In: Contemporary infrared standards and calibration; Proceedings of the Meeting, San Diego, CA, August 25, 26, 1981. Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 107-111.

A calibration system and techniques developed to calibrate the highly accurate infrared target source of the AN/AAM-60 Common FLIR Test Bench, an automated system for testing FLIR's, are presented. The established calibration hierarchy links the contrast of the infrared target source test patterns to radiometric standards at the National Bureau of Standards and comprises infrared radiometers and portable ambient range blackbodies together with ancillary equipment. The radiometers are calibrated in terms of the temperature of special-purpose ambient range blackbody standards at Navy calibration laboratories. The blackbodies are calibrated by the Navy Primary Standards Department against a master blackbody directly traceable to the National Bureau of Standards. V.L.

A83-23149

INITIAL DESIGN OF STRINGER STIFFENED BEND BOXES USING GEOMETRIC PROGRAMMING

M. B. SNELL and P. BARTHOLOMEW (Royal Aircraft Establishment, Materials and Structures Dept., Farnborough, Hants., England) Aeronautical Journal, vol. 87, Jan. 1983, p. 21-25. refs

The technique of geometric programming is applied to the design of optimum wing bend boxes in sheet-stringer-rib construction. The work extends the previous application in multi-spar design and the results for the different configurations are compared. Closed-form design equations are given for the case of buckling constraints whereas more complex formulations with stress constraint were solved by computer. (Author)

A83-23221#

APPLICATION OF THE MATRIX METHOD OF FORCES FOR THE CALCULATION OF AIRCRAFT STRUCTURES [ZASTOSOWANIE MACIERZOWEJ METODY SIL W OBLICZENIACH KONSTRUKCJI LOTNICZYCH]

J. JACHIMOWICZ Instytut Lotnictwa, Prace, no. 89, 1982, p. 61-93. In Polish. refs

Some applications of the matrix method of forces, based on the natural mode technique, are discussed. Particular consideration is given to the application of this method to the analysis of the middle part of the fuselage of the Mi-2M helicopter. B.J.

A83-23248#

DEVELOPMENT OF THE BASIC METHODS NEEDED TO PREDICT HELICOPTERS' AEROELASTIC BEHAVIOUR

R. DAT (ONERA, Chatillon-sous-Bagneux, Hauts-de-Seine, France) ONERA, TP no. 1982-75, 1982. 29 p. refs (ONERA, TP NO. 1982-75)

The problems of structural dynamics, blade unsteady aerodynamic forces, stability and forced vibrations of the coupled rotor-fuselage structure are discussed. The paper shows the peculiarities of the basic calculation methods developed at ONERA in cooperation with the Aerospatiale. Some of these methods have been derived from the formulations used by the fixed wing specialists. (Author)

N83-16566# Army Engineer Waterways Experiment Station, Vicksburg, Miss. Geotechnical Lab.

PREDICTION OF PAVEMENT ROUGHNESS Final Report

W. R. BARKER Sep 1982 91 p refs

(Contract DA PROJ. 4A1-61101-A-910)

(AD-A120009; WES/MP-GL-82-11) Avail: NTIS HC A05/MF

A01 CSCL 13M

A simplified procedure has been developed for considering roughness in pavement design. The procedure utilizes statistical parameters to generate stochastic pavement material properties and profiles. A methodology was developed for predicting the rutting of a pavement section due to applied traffic. Thus the predicted rut depth can be applied to the profiles yielding a predicted surface profile. This profile can then be used to determine a measure of pavement roughness. Author (GRA)

N83-16758*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ROLLING-ELEMENT FATIGUE LIFE OF AMS 5900 BALLS

R. J. PARKER Jan. 1983 13 p refs

(NASA-TP-2080; E-1190; NAS 1.60-2080) Avail: NTIS HC

A02/MF A01 CSCL 13I

The rolling-element fatigue life of AMS 5900 12.7-mm (1/2-in.) dia was determined in five-ball fatigue testers. The 10% life with the warm headed AMS 5900 balls was equivalent to that of AMS 5749 and over eight times that of AISI M-50. The AMS balls fabricated by cold heading had small surface cracks which initiated fatigue spalls where these cracks were crossed by running tracks. The cold-headed AMS 5900 balls had a 10% fatigue life an order of magnitude less than that of the warm headed balls even when failures on the cold headed balls at visible surface cracks were omitted. Author

N83-16760# Battelle Columbus Labs., Ohio.

TECHNICAL AND SECRETARIAT SUPPORT OF THE MIL-STD-1515 FASTENER STANDARDIZATION EFFORT Final Report, Jun. 1976 - Mar. 1982

S. C. FORD and O. L. DEEL Wright-Patterson AFB, Ohio Aeronautical Systems Div. May 1982 24 p

(Contract F33615-76-C-0803)

(AD-A119828; ASD-TR-82-5008) Avail: NTIS HC A02/MF A01

CSCL 05B

This report presents the major activities associated with the subject contract. The Aeromechanical Fastener Requirements Group (AMFRG) composed of the Air Force, Navy, Army, prime aerospace manufacturers, and fastener manufacturers was reorganized in 1976 to efficiently prepare and maintain MIL-STD-1515, Fastener Systems for Aerospace Applications. Twice yearly meetings were arranged, attended, technical support provided, and minutes prepared and distributed. MIL-STD-1515 was completely revised and two change notices to the revised document were completed and published. Research programs involving stress corrosion, fatigue properties of recess head fasteners, and removal torque measurements of fasteners installed in various aircraft were completed during the contract term.

Author (GRA)

N83-16765# Technische Univ., Berlin (West Germany). Inst. fuer Luft- und Raumfahrt.

WATER INJECTION INTO COMPRESSORS OF GAS TURBINES FOR POWER INCREASE AND REDUCTION OF NOX EMISSION Final Report, Dec. 1980

M. WEICHERT Bonn Bundesministerium fuer Forschung und Technologie May 1982 54 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-T-82-075; ISSN-0340-7608) Avail: NTIS HC A04/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 11,50

The injection of water into gas turbine compressors was investigated in order to increase the power and to reduce NOX emission. A test stand was erected. The use of coaxial rotational symmetrically mounted swirl nozzles enables the collection of large droplets before they enter the compressor. The use of ultrasound to produce water droplets of equal size promises even better results. Increase of power, improvement of compressor efficiency and reduction of NOX emission are proven. This system can be used for all types of gas turbines, for different applications.

Author (ESA)

N83-17748# Stuttgart Univ. (West Germany) Inst. fuer Statik und Dynamik.

AN INTERACTIVE SYSTEM FOR TRANSFORMATION OF KNOWN MEASURES LONG INTERNAL SURFACE OF CYLINDERS MODEL FOR SHAFTS [EIN INTERAKTIVES SYSTEM ZUR UMWANDLUNG DER KENNGROESSEN LANGE ZYLINDERSCHALE-BALKENMODELL]

W. LANG May 1982 96 p refs In GERMAN; ENGLISH summary

(Contract BMFT-03-E-4406-A)

(ISD-294; ISSN-0170-6071) Avail: NTIS HC A05/MF A01

During the layout of rotor blades under structural aspects, uncomplicated and cost effective calculation models should be applied when using the finite element method (FE-method). This is necessary since calculation normally has to be repeated several times to get an optimum solution. The application of beam elements instead of more expensive shell elements takes these facts into account. For FE-Analysis using beam elements several equivalent cross-sectional data - moments of inertia, torsion constant, position of shear center - have to be given. These values are derived from the data of the spar such as cross-sectional geometry, wall thickness and material data. This step of preparing the data in connection with their interactive modification is automatically done by the presented software.

S.L.

N83-17749# Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany). Transport und Verkehrsflugzeuge.

SERVICE OPERATION OF A CFRP WINDOW FRAME IN SHORT FIBER PRESSING Final Report, Feb. 1981

F. HEINZE and G. STEMMER Bonn Bundesministerium fuer Forschung und Technologie Sep. 1982 110 p refs In GERMAN; ENGLISH summary Sponsored by Bundesministerium fuer Forschung und Technologie

(BMFT-FB-W-82-021; ISSN-0170-1339) Avail: NTIS HC A06/MF A01; Fachinformationszentrum, Karlsruhe, West Germany DM 23

Carbon fiber reinforced plastic (CFRP) aircraft window frame research is reported.

Author

N83-17770# Federal Aviation Administration, Atlantic City, N.J. **MODE S BASELINE RADAR TRACKING Final Report, Jan. - Mar. 1981**

E. F. MANCUS and L. H. BAKER Nov. 1982 96 p refs

(Contract FAA PROJ. 034-243-510)

(FAA-RD-82-53; FAA-CT-82-43) Avail: NTIS HC A05/MF A01

The baseline performance characteristics of the moving target detector (MTD) and radar data acquisition system (RDAS) as an integral part of the Mode S sensor, were determined. The MTD and RDAS were separately evaluated to determine their capability to provide radar data suitable for utilization by the Mode S sensor

and automated radar terminal system (ARTS). The design modifications made to the Mode S sensor to provide the capability of interfacing to either an MTD or RDAS were evaluated to determine if they were in compliance with the Federal Aviation Administration engineering requirement, FAA-ER-240-26. Radar baseline technical performance data was provided to characterize the MTD, RDAS, Mode S, and ARTS. The minimum radar tracking requirements are studied to determine if they are adequate to provide reliable radar track data to an air traffic control facility. It was concluded that the Mode S sensor, when integrated with an MTD-2 radar digitizer, can provide reliable primary radar track data to the ARTS III system for automated radar track acquisition.

S.L.

N83-17855# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

GYROSCOPIC INSTRUMENTS AND THEIR APPLICATION TO FLIGHT TESTING

B. STIELER and H. WINTER Sep. 1982 216 p refs

(AGARD-AG-160-VOL-15; ISBN-92-835-1433-5) Avail: NTIS HC A10/MF A01

The use of gyroscopic instruments to support flight testing is discussed. Gyroscopic instruments are used in flight tests to measure the aircraft angular accelerations and rates, attitude and heading and - in combination with accelerometers - the linear acceleration, the ground velocity and the position. The measuring principles, the technical layout and the error behavior of the sensors and systems used for these measurements are described. Gyros, accelerometers, attitude and heading references and inertial navigation systems are included. Integrated and hybrid sensor systems as they are used in modern instrumentation systems are considered. Examples of actual flight instrumentation systems are described and the requirements for the gyroscopic sensors in these systems are discussed for applications in aircraft stability and control flight tests, in performance tests and in airborne and ground systems calibration and testing.

S.L.

N83-17880*# General Electric Co., Cincinnati, Ohio. Aircraft Engine Business Group.

BEARING FATIGUE INVESTIGATION 3 Final Report

A. H. NAHM, E. N. BAMBERGER, and H. SIGNER (Industrial Tectonics, Inc., Compton, Calif.) May 1982 83 p refs (Contract NAS3-15337)

(NASA-CR-168029; NAS 1.26 168029; GE-R82AEB304) Avail: NTIS HC A05/MF A01 CSCL 131

The operating characteristics of large diameter rolling-element bearings in the ultra high speed regimes expected in advanced turbine engines for high performance aircraft were investigated. A high temperature lubricant, DuPont Krytox 143 AC, was evaluated at bearing speeds to 3 million DN. Compared to the results of earlier, similar tests using a MIL-L-23699 (Type II) lubricant, bearings lubricated with the high density Krytox fluid showed significantly higher power requirements. Additionally, short bearing lives were observed when this fluid was used with AISI M50 bearings in an air atmosphere. The primary mode of failure was corrosion initiated surface distress (fatigue) on the raceways. The potential of a case-carburized bearing to sustain a combination of high-tangential and hertzian stresses without experiencing race fracture was also investigated. Limited full scale bearing tests of a 120 mm bore ball bearing at a speed of 25,000 rpm (3 million DN) indicated that a carburized material could sustain spalling fatigue without subsequent propagation to fracture. Planned life tests of the carburized material had to be aborted, however, because of apparent processing-induced material defects. J.M.S.

N83-17899*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

STRUCTURAL TESTING FOR STATIC FAILURE, FLUTTER AND OTHER SCARY THINGS

R. H. RICKETTS Jan. 1983 43 p refs Presented at the Ann. Conv. of Exptl. Aircraft Assoc., Oshkosh, Wis., Aug. 1982 (NASA-TM-84606; NAS 1.15:84606) Avail: NTIS HC A03/MF A01 CSCL 20L

Ground test and flight test methods are described that may be used to highlight potential structural problems that occur on aircraft. Primary interest is focused on light-weight general aviation airplanes. The structural problems described include static strength failure, aileron reversal, static divergence, and flutter. An example of each of the problems is discussed to illustrate how the data acquired during the tests may be used to predict the occurrence of the structural problem. While some rules of thumb for the prediction of structural problems are given the report is not intended to be used explicitly as a structural analysis handbook. Author

N83-17902# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

FATIGUE THRESHOLD AND SHORT CRACK SIGNIFICANCE FOR AIRCRAFT

R. J. H. WANHILL 6 Jan 1982 7 p refs Presented at 8th Australasian Conf. on the Mech. of Struct. and Mater., 23-26 Aug. 1982

(NLR-MP-82007-U) Avail: NTIS HC A02/MF A01

The significance of fatigue thresholds and short cracks for aircraft structures with respect to the design and operating requirements of safety, durability and inspectability is considered

E.A.K.

N83-17903# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.

CREEP AND FATIGUE INTERACTIONS IN A NICKEL BASE SUPERALLOY

H. J. KOLKMAN and R. J. H. WANHILL Jan. 1982 8 p Presented at 6th Intern. Conf. on Strength of Metals and Alloys, Melbourne, Aug. 1982 Sponsored by Royal Netherlands Air Force Scientific Research Div., Directorate of Materiel

(NLR-MP-82003-U) Avail: NTIS HC A02/MF A01

The influences of prior creep on fatigue life and of prior fatigue on creep life for Rene 80 nickel base superalloy bars were investigated. Aircraft gas turbine components are subjected to combinations of creep and fatigue. For any particular service problem it is important to recognize the relative contributions of creep and fatigue. The influences are profound and sometimes highly beneficial and have important practical implications. Most of the results are explained from microstructural investigation by transmission electron microscopy. Fracture surface examination does not show reliable differences between specimens subjected to fatigue and prior creep and fatigue. It is concluded that the used fractography as a diagnostic tool for service failure analysis is limited in the case of creep and fatigue interactions. E.A.K.

GEOSCIENCES

Includes geosciences (general), earth resources; energy production and conversion; environment pollution; geophysics, meteorology and climatology; and oceanography.

A83-22703* National Aeronautics and Space Administration Marshall Space Flight Center, Huntsville, Ala.

OBSERVATIONS OF OPTICAL LIGHTNING EMISSIONS FROM ABOVE THUNDERSTORMS USING U-2 AIRCRAFT

H. J. CHRISTIAN, R. L. FROST, P. H. GILLASPY, S. J. GOODMAN, O. H. VAUGHAN, JR. (NASA, Marshall Space Flight Center, Huntsville, AL), M. BROOK (New Mexico Institute of Mining and Technology, Socorro, NM), B. VONNEGUT, and R. E. ORVILLE (New York, State University, Albany, NY) American Meteorological Society, Bulletin, vol. 64, Feb. 1983, p. 120-123. refs

In order to determine how to achieve orders of magnitude improvement in spatial and temporal resolution and in sensitivity of satellite lightning sensors, better quantitative measurements of the characteristics of the optical emissions from lightning as observed from above tops of thunderclouds are required. A number of sensors have been developed and integrated into an instrument package and flown aboard a NASA U-2 aircraft. The objectives have been to acquire optical lightning data needed for designing the lightning mapper sensor, and to study lightning physics and the correlation of lightning activity with storm characteristics. The instrumentation and observations of the program are reviewed and their significance for future research is discussed. (Author)

N83-16814*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.

PROGRAM TO COMPUTE THE POSITIONS OF THE AIRCRAFT AND OF THE AIRCRAFT SENSOR FOOTPRINTS

J. F. PARIS, Principal Investigator Sep. 1982 20 p Sponsored by NASA, USDA, Dept. of Commerce, Dept. of the Interior, and Agency for International Development ERTS (Contract PROJ. AGRISTARS)

(E83-10139; NASA-TM-85199; SR-J2-04360; JSC-18574; NAS 1.15:85199) Avail: NTIS HC A02/MF A01 CSCL 02C

The positions of the ground track of the aircraft and of the aircraft sensor footprints, in particular the metric camera and the radar scatterometer on the C-130 aircraft, are estimated by a program called ACTRK. The program uses the altitude, speed, and attitude information contained in the radar scatterometer data files to calculate the positions. The ACTRK program is documented. Author

N83-16951*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

MULTIPLE-EVENT AIRPLANE NOISE ANNOYANCE

C. A. POWELL Jan. 1983 34 p refs (NASA-TP-2101; L-15517; NAS 1.60:2101) Avail: NTIS HC A03/MF A01 CSCL 13B

The annoyance of sessions of airplane noise which contained different noise levels and numbers of flyovers was investigated. The time of occurrence of the high noise level flyovers in the sessions did not significantly affect annoyance, but annoyance increased with the number of such flyovers. Annoyance decreased with test session duration but increased with the total number of flyovers in the test sessions. It is found that the results support an average energy model better than a total energy model, the annoyance decay model, or the dB(A) peak concept. E.A.K.

N83-17460# Federal Aviation Administration, Washington, D.C. Energy Div.
AN OVERVIEW OF THE DOT/FAA AVIATION ENERGY CONSERVATION POLICY
 C. J. HOCH *In* DOE Symp. on Com. Aviation Energy Conserv. Strategies p 79-94 Apr. 1981
 Avail. NTIS HC A17/MF A01 CSDL 01B
 An overview of the FAA aviation energy conservation policy is presented. NW.

N83-18106# Pacific Northwest Lab., Richland, Wash.
COMPOSITE DESIGN OF AN ADVANCED AIRBORNE MONITORING SYSTEM
 K. M. BUSNESS, A. J. ALKEZWEENY, R. C. EASTER, J. M. HALES, and R. N. LEE Dec. 1981 16 p refs Presented at the Spec. Conf. on In-Situ Air Quality Monitoring from Moving Platforms, San Diego, Calif., 18 Jan. 1982
 (Contract DE-AC06-76RL-01830)
 (DE82-006980; PNL-SA-10089, CONF-820117-1) Avail: NTIS HC A02/MF A01

Atmospheric chemistry investigations often require a multitude of measurements which can be obtained only through the utilization of airborne sampling platforms. Instrument limitations and the aircraft environment present several considerations for sampling-system design, including such factors as instrument sensitivities and response times, altitude effects, sampling intervals for acquiring samples, and physical compatibility with the aircraft. An aircraft system with an extensive evolutionary instrument array has been in development at PNL for several years during which several special systems have been developed to improve aircraft measurement capabilities. A high-volume air sampling system providing flows of up to 4 cu m/min and simultaneous collection of three filters in parallel has been constructed to reduce filter collection times. A constant pressure inlet system was developed to overcome adverse effects in instrument response resulting from altitude changes. DOE

15

MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

A83-20289#
EXTENDED PERFECT MODEL FOLLOWING
 T. OKADA and M. KIHARA (Defense Academy, Yokosuka, Kanagawa, Japan) JSME, Bulletin, vol. 25, Dec. 1982, p. 1985-1993. refs

The perfect model following (PMF) is an established technique in control system synthesis which has such a characteristic that the state variables of plant perfectly follow those of model. However, the condition for PMF to be able to synthesize is rather severe. In order to relax this condition and enable easy synthesis of PMF system, extended PMF (EPMF) is proposed. EPMF is a PMF where the output (not state variables) of plant perfectly follows that of model. A condition of EPMF and design procedure of EPMF are derived. Sensitivity reduction in EPMF is analyzed. Design examples for some systems and an aircraft control system are performed and simulated. Possibility of wide application and desirable characteristics of EPMF are shown. (Author)

A83-20398#
CURVATURE TRANSITIONS OF COMPOSITE CURVES AND SURFACES - QUESTIONS REGARDING DETAILS OF COMPUTER-AIDED DESIGN [KRUEMMUNGSUEBERGAENGE ZUSAMMENGESETZTER KURVEN UND FLAECHEEN - DETAILFRAGEN DES COMPUTER AIDED DESIGN]
 J. KAHMANN Braunschweig, Technische Universitaet, Naturwissenschaftliche Fakultae, Doktor der Naturwissenschaften Dissertation, 1982. 115 p. In German. refs

The design and the construction of curves and surfaces has to satisfy often certain aesthetic or physical requirements. Thus, in aircraft design the characteristics of curves and surfaces are determined widely by aerodynamic considerations. It was found that classical design processes are not very practical in connection with the utilization of computer-aided design procedures. New design approaches consider surfaces which are composed of segments of two-dimensional polynomials of low degree. In connection with the segmentation of surfaces, the problem of finding smooth transitions arises. The present investigation is concerned with a procedure for the determination of smooth transitions. There are no conditions regarding the differentiability of parameter lines. However, for each point of the curve separating two segments, a common tangent plane and a common normal section curvature for every direction are needed. G.R.

A83-22825* SRI International Corp., Menlo Park, Calif.
THE SOFTWARE-IMPLEMENTED FAULT TOLERANCE /SIFT/ APPROACH TO FAULT TOLERANT COMPUTING
 J. GOLDBERG (SRI International Computer Science Laboratory, Menlo Park, CA) *In*: Real-time signal processing IV; Proceedings of the Meeting, San Diego, CA, August 25-28, 1981 Bellingham, WA, SPIE - The International Society for Optical Engineering, 1982, p. 289-293. refs
 (Contract NAS1-15428)

SIFT is an experimental computer designed for highly reliable flight-control service in advanced air transports. Its development was intended to integrate and demonstrate the latest techniques in fault-tolerant computing. During its development, several new problems of some generality were uncovered and solved. The technology developed for the validation of its design is seen as being perhaps as important as the design itself. The SIFT design is described, as is the way in which the design and its validation were shaped by the requirements of its intended application. Attention is also given to reliability and fault tolerance. The most significant feature of the hardware design is the absence of elements that can generate multiple faults, such as shared clocks or data buses. It is noted that the software is realized in only 800 lines of code, of which 80% are in a high-level language. C.R.

N83-17482# Office National d'Etudes et de Recherches Aeronautiques, Paris (France).
AEROELASTIC EQUILIBRIUM OF AN HELICOPTER ROTOR WITH NONLINEAR AERODYNAMIC FORCES
 J. J. COSTES *In* AGARD Prediction of Aerodyn. Loads on Rotorcraft 21 p Sep. 1982 refs *In* FRENCH; ENGLISH summary
 Avail: NTIS HC A14/MF A01

A computer code which includes aeroelastic couplings for stalled flight cases is presented. The modification of the classical linear aerodynamics to include stall is examined. The nonlinear forces are given by mathematical models and a single nonlinear system of equations, written in a form suitable for a step by step resolution is obtained. Examples and a few comparisons between theory and experiment are given. E.A.K.

N83-17483# Costruzioni Aeronautiche Giovanni Agusta S.p.A., Varese (Italy). Dynamics Engineering Dept.

FIRST RESULTS FOR THE DEFINITION OF A GENERAL ROTORCRAFT DYNAMIC PROGRAM

A. RUSSO and A. CERIOTTI /In AGARD Prediction of Aerodyn. Loads on Rotorcraft 14 p Sep. 1982 refs

Avail: NTIS HC A14/MF A01

A computer program able to solve the large number of problems related to the dynamic behavior of a rotor or a complete helicopter is described. The analytical model is described by a technique similar to the finite element analysis, the equations of motion are obtained by general equation of dynamics, in its standard matrix form. The operations are the linearization, around the actual position of dynamic equilibrium, of the equations of motion and constraint equations. Forcing functions can be either forces or imposed displacements depending on time as well as on any kinematic value of other elements or their own kinematic value. The steady aerodynamic coefficients are computed from the local incidence deduced by means of kinematic, gust, and induced velocities of the rotor wakes introduced into the model. Particular attention is paid to the input data both for a rational description of the model and not to cause format troubles to the user. E.A.K.

N83-17485# Army Research and Technology Labs., Moffett Field, Calif.

THE DEVELOPMENT OF A SYSTEM FOR INTERDISCIPLINARY ANALYSIS OF ROTORCRAFT FLIGHT CHARACTERISTICS

A. W. KERR and W. B. STEPHENS (Army Aeromechanics Labs.) /In AGARD Prediction of Aerodyn. Loads on Rotorcraft 14 p Sep. 1982 refs

Avail: NTIS HC A14/MF A01

A comprehensive, interdisciplinary analysis system was developed to predict the technical characteristics of a wide variety of rotary wing configurations. The approach used in the development of the system is reviewed and the software methodology used to support the development is described. The mathematical basis for the system and the top level analysis and architectural design of the system are presented. The potential ability of the system to predict rotor loads is discussed. E.A.K.

N83-17489# Army Research and Technology Labs., Fort Eustis, Va. Applied Technology Lab.

DATAMAP AND ITS IMPACT ON PREDICTION PROGRAMS

D. J. MERKLEY and A. E. RAGOSTA /In AGARD Prediction of Aerodyn. Loads on Rotorcraft 13 p Sep. 1982 refs

Avail: NTIS HC A14/MF A01

The DATAMAP (data from aeromechanics' test and analytics--management and analysis package), a computer software system that provides direct access to large time history data bases, performs analyses and derivations, and displays the data in various formats, interactively or through batch processing is described. The ability of directly comparing analytical, model and full scale test results is emphasized; the care which must be taken when utilizing DATAMAP; and its effect on the plans for the second generation comprehensive helicopter analysis system is emphasized (2GCHAS). The operational loads survey (OLS) data base is described and the development of DATAMAP is discussed. The DATAMAP's versatility is shown and its ability to access any time history data base and its modular concept whereby any appropriate analysis or derivation can be added to the existing capabilities as the need arises are emphasized. Plots which show various formats that are available to the user are presented. E.A.K.

N83-18291# National Aerospace Lab., Amsterdam (Netherlands). Flight Div.

COMPUTERS IN AVIONICS SYSTEMS

F. J. ABBINK 25 Dec. 1981 35 p refs In DUTCH; ENGLISH summary Presented at Computer Technol. Symp., Delft, 19 Jan. 1982

(NLR-MP-81063-U) Avail: NTIS HC A03/MF A01

Avionics provide functions related with flight control, navigation, communication, systems monitoring and presentation of flight,

warning and systems information. The avionics concept for airliners and the role of microelectronics, microcomputers and modern display technology to reduce fuel consumption and flight crew workload are described C.S.L.

N83-18295# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France).

DISTRIBUTED MICRO-PROCESSOR APPLICATIONS TO GUIDANCE AND CONTROL SYSTEMS

L. J. URBAN, ed. (Aeronautical Systems Div.) Jul. 1982 113 p (AGARD-AR-178; ISBN-92-835-1428-9) Avail: NTIS HC A06/MF A01

Microprocessor technology is described. Guidance and control architecture is detailed. A lexicon of terminology is provided. Standardization is highlighted.

N83-18297# Boeing Military Airplane Development, Seattle, Wash.

MICROPROCESSOR APPLICATIONS TO GUIDANCE AND CONTROL ARCHITECTURES

R. F. BOUSLEY /In AGARD Distributed Micro-Process. Appl. to Guidance and Control Systems p 61-84 Jul. 1982

Avail: NTIS HC A06/MF A01

A sample of techniques now being examined for use of microprocessor hardware and software in future military G&C systems is presented. Some current and proposed architectures are discussed. The structure of the basic types of architectures is examined. Computational considerations are presented as well as software and fault tolerance considerations for each type of architecture. These architectures are applied to integrated G&C systems for generic types of aircraft. A comparison of benefits through the use of each of these types of architecture made possible through the use of microprocessors is presented.

Author

N83-18304*# Boeing Commercial Airplane Co., Seattle, Wash. **USER'S MANUAL FOR MASTER: MODELING OF AERODYNAMIC SURFACES BY 3-DIMENSIONAL EXPLICIT REPRESENTATION Final Report**

S. G. GIBSON Jan. 1983 164 p refs

(Contract NAS1-15325-10)

(NASA-CR-166056; NAS 1.26:166056; D6-51088; B-8406) Avail.

NTIS HC A08/MF A01 CSCL 09B

A system of computer programs was developed to model general three dimensional surfaces. Surfaces are modeled as sets of parametric bicubic patches. There are also capabilities to transform coordinates, to compute mesh/surface intersection normals, and to format input data for a transonic potential flow analysis. A graphical display of surface models and intersection normals is available. There are additional capabilities to regulate point spacing on input curves and to compute surface/surface intersection curves. Input and output data formats are described; detailed suggestions are given for user input. Instructions for execution are given, and examples are shown. J.M.S.

N83-18307*# North Carolina State Univ., Raleigh. Dept. of Electrical Engineering.

A STUDY OF REAL-TIME COMPUTER GRAPHIC DISPLAY TECHNOLOGY FOR AERONAUTICAL APPLICATIONS Final Report, Jan. 1977 - Sep. 1982

S. A. RAJALA and L. R. BLUME May 1983 165 p refs

(Contract NSG-1355)

(NASA-CR-169828; NAS 1.26:169828) Avail: NTIS HC A08/MF A01 CSCL 09B

Hardware, algorithms and software for real-time raster graphics were designed and implemented. Author

N83-18322# Naval Research Lab., Washington, D. C. Computer Science and Systems Branch.

THE A-7E SOFTWARE REQUIREMENTS DOCUMENT: THREE YEARS OF CHANGE DATA

L. J. CHMURA and D. M. WEISS 8 Nov. 1982 24 p refs
(Contract RR0140941)
(AD-A121602; AD-E000506; NRL-MR-4938) Avail: NTIS HC A02/MF A01 CSCL 09B

A major product of the Naval Research Laboratory's Software Cost Reduction project is the software requirements document for the Navy's A-7E aircraft operational flight program. The document, which was first published in November 1978, is intended to serve as a model for specifying complex software systems. We have monitored all changes to the document. The change data have consistently suggested that the specification has several desirable qualities, for example, it is easily maintained and is remarkably free of inappropriate implementation detail. GRA

16

PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy physics; optics; plasma physics; solid-state physics, and thermodynamics and statistical physics.

A83-19808*# Purdue Univ., Lafayette, Ind.

THEORETICAL AND EXPERIMENTAL EVALUATION OF TRANSMISSION LOSS OF CYLINDERS

Y. S. WANG, M. J. CROCKER (Purdue University, West Lafayette, IN), and P. K. RAJU AIAA Journal, vol. 21, Feb. 1983, p. 186-192. refs
(Contract NAG1-58)

(Previously cited in issue 24, p. 4127, Accession no. A81-48612)

A83-19810#

EIGENSOLUTIONS FOR LINERS IN UNIFORM MEAN FLOW DUCTS

W. KOCH (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Institut fuer theoretische Stroemungsmechanik, Goettingen, West Germany) and W. MOEHRING (Max-Planck-Institut fuer Stroemungsforschung, Goettingen, West Germany) AIAA Journal, vol. 21, Feb. 1983, p. 200-213. refs

(Previously cited in issue 24, p. 4246, Accession no. A81-48646)

A83-19811#

EFFECT OF EXCITATION ON COAXIAL JET NOISE

H. Y. LU (Boeing Commercial Airplane Co., Seattle, WA) AIAA Journal, vol. 21, Feb. 1983, p. 214-220. refs

(Previously cited in issue 24, p. 4129, Accession no. A81-48651)

A83-19813*# California Univ., Los Angeles.

AEROSOUND FROM CORNER FLOW AND FLAP FLOW

W. C. MEECHAM (California, University, Los Angeles, CA) AIAA Journal, vol. 21, Feb. 1983, p. 228-234. NASA-supported research. refs

(AIAA PAPER 81-2039)

(Previously announced in STAR as N82-32081)

A83-19814*# National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SCREECH SUPPRESSION IN SUPERSONIC JETS

T. D. NORUM (NASA, Langley Research Center, Hampton, VA) AIAA Journal, vol. 21, Feb. 1983, p. 235-240. refs

(Previously cited in issue 06, p. 941, Accession no. A82-17753)

A83-20364* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

RADIATION FROM A DOUBLE LAYER JET

R. DASH (NASA, Ames Research Center, Moffett Field, CA) Acoustical Society of America, Journal, vol. 73, Jan. 1983, p. 128-136. refs

The aerodynamic radiation caused by two acoustic point sources located symmetrically on the sides of a double layer jet which produces a velocity discontinuity was examined, with attention given to the effect on the sound by the stream. Basic equations were defined in terms of wave propagation in the fluid in motion and a Fourier transformation. It was found that the radiation due to a point source on one side of the jet is enhanced by the presence of sound transmitted from the other side. The effect is expressed as a function of the reflection coefficient, wherein the reflections take place at the vortex interfaces separating the fluid in motion from the fluid at rest. The intensity patterns were determined to be kidney-shaped, lung-shaped, and heart-shaped, and characterized by a deep valley in the directivity pattern. The significance of the findings for STOL aircraft ejector thrust augmentation is mentioned. M.S.K.

A83-22128*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CONVENTIONAL PROFILE COAXIAL JET NOISE PREDICTION

J. R. STONE, D. E. GROESBECK, and C. L. ZOLA (NASA, Lewis Research Center, Cleveland, OH) AIAA Journal, vol. 21, Mar. 1983, p. 336-342. refs

(Previously cited in issue 24, p. 4249, Accession no. A81-49743) 12, p.

A83-22161#

ACOUSTIC ENVIRONMENT IN LARGE ENCLOSURES WITH A SMALL OPENING EXPOSED TO FLOW

L. SHAW (USAF, Flight Dynamics Laboratory, Wright-Patterson AFB, OH), H. BARTEL, and J. MCAVOY (Lockheed-Georgia Co., Structures Technology Div., Marietta, GA) Journal of Aircraft, vol. 20, Mar. 1983, p. 250-256 refs

(Previously cited in issue 06, p. 941, Accession no. A82-17795)

N83-17235* National Aeronautics and Space Administration. Langley Research Center, Hampton, Va.

SOUND SHIELD Patent

T. R. CREEL, JR. and I. E. BECKWITH, inventors (to NASA) 28 May 1981 7 p Filed 28 May 1981 Supersedes N81-39138 (19 - 20, p. 2729)

(NASA-CASE-LAR-12883-1; US-PATENT-4,363,237;

US-PATENT-APPL-SN-267935; US-PATENT-CLASS-73-147)

Avail: US Patent and Trademark Office CSCL 20A

An improved test section for a supersonic or hypersonic wind tunnel is disclosed wherein the model tested is shielded from the noise normally radiated by the turbulent tunnel wall boundary layer. A vacuum plenum surrounds spaced rod elements making up the test chamber to extract some of the boundary layer as formed along the rod elements during a test to thereby delay the tendency of the rod boundary layers to become turbulent. Novel rod construction involves bending each rod slightly prior to machining the bent area to provide a flat segment on each rod for connection with the flat entrance fairing. Rods and fairing are secured to provide a test chamber incline on the order of 1 deg outward from the noise shield centerline to produce up to 65% reduction of the root mean square (rms) pressure over previously employed wind tunnel test sections at equivalent Reynolds numbers.

Official Gazette of the U.S. Patent and Trademark Office

N83-17237*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.

EFFECTS OF FLIGHT ON NOISE RADIATED FROM CONVECTED RING SOURCES IN COAXIAL DUAL FLOW. PART 2: THE NOISE FROM HEATED JETS

R. DASH Aug. 1982 53 p refs

(Contract NCC2-75)

(NASA-CR-169736; NAS 1.26:169736; SU-JIAA-TR-48-PT-2)

Avail: NTIS HC A04/MF A01 CSCL 20A

The effects of flight on noise from heated jets are discussed. The effects of the additionally, extraneously-generated dipole and simple source terms which arise as a result of the density gradients across the fluid interfaces were incorporated. The coaxial flows with inverted profiles are shown to be quieter than the conventional profiles; however, the benefit of noise reduction at higher outer-to-inner area ratios is totally offset as the inverted profile incurs a significant massloss and thrust-loss. Amongst all the possible coaxial configurations when on of the coaxial streams is heated-conventional profile (CP), inverted profile (IP) and the variable stream control engine (VSCE) cycle-and at constant massflow and thrust, a VSCE-cycle is the most desirable and the best possible engine cycle inasmuch as it provides over more than 18.0 dB reduction in SPL (as compared against noise from a CP-cycle) at all angles, both statically and in flight, for area ratios Sigma 0.25. Author

N83-17238*# Stanford Univ., Calif. Joint Inst. for Aeronautics and Acoustics.

EFFECTS OF NOISE RADIATED FROM CONVECTED RING SOURCES IN COAXIAL DUAL FLOW. PART 1: THE NOISE FROM UNHEATED JETS

R. DASH Aug. 1982 58 p refs

(Contract NCC2-75)

(NASA-CR-169737; NAS 1.26:169737; SU-JIAA-TR-48-PT-1)

Avail: NTIS HC A04/MF A01 CSCL 20A

The effects of flight on sound radiated from embedded, uncorrelated ring sources convecting along the midst of the primary and the secondary streams of a coaxial dual flow which emerges from a moving nozzle into the ambience are studied. Cold jets are examined. The problem is posed as a double vortex-sheet flow model which involves deliberate suppression of inherent instabilities of the flow and is formulated, as a linear problem, in terms of the combined contributions of two independent uncorrelated quadrupole-type ring sources, the one convecting in the primary flow representing the sources generated due to the interaction at the primary/secondary interface and the other convecting in the secondary flow representing the sources generated due to the interaction at the secondary/ambient interface. The analysis shows that the effects of flight induce (1) amplification of noise in the forward quadrant, (2) reduction of noise in the aft quadrant and (3) absolutely no impact on radiation of noise at Theta = 90 deg to the jet axis. Author

N83-17239*# Kentron Technical Center, Hampton, Va.

COMPARISON OF FORWARD FLIGHT EFFECTS THEORY OF A. MICHALKE AND U. MICHEL WITH MEASURED DATA Final Report

J. W. RAWLS, JR. Washington NASA Jan. 1983 53 p refs

(Contract NAS1-16000)

(NASA-CR-3665; NAS 1.26:3665) Avail: NTIS HC A04/MF A01 CSCL 20A

The scaling laws of a Michalke and Michel predict flyover noise of a single stream shock free circular jet from static data or static predictions. The theory is based on a farfield solution to Lighthill's equation and includes density terms which are important for heated jets. This theory is compared with measured data using two static jet noise prediction methods. The comparisons indicate the theory yields good results when the static noise levels are accurately predicted. Author

N83-17242*# Garrett Turbine Engine Co., Phoenix, Ariz.

COMPUTER PROGRAM TO PREDICT NOISE OF GENERAL AVIATION AIRCRAFT: USER'S GUIDE Final Report

J. A. MITCHELL, C. K. BARTON, L. S. KISNER, and C. A. LYON Sep. 1982 281 p refs

(Contract NAS3-23037)

(NASA-CR-168050; NAS 1.26:168050; GARRETT-21-4270-2)

Avail: NTIS HC A13/MF A01 CSCL 20A

Program NOISE predicts General Aviation Aircraft far-field noise levels at FAA FAR Part 36 certification conditions. It will also predict near-field and cabin noise levels for turboprop aircraft and static engine component far-field noise levels. Author

N83-17246# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamic Environment Branch.

USAF ENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 150: C-140 IN-FLIGHT CREW NOISE

H. K. HILLE Sep. 1982 18 p refs

(Contract AF PROJ. 7231)

(AD-A120508; AMRL-TR-75-50-VOL-150) Avail: NTIS HC A02/MF A01 CSCL 01B

The C-140 is a USAF transport aircraft used for operational support. This report provides measured data defining the bioacoustic environments at flight crew/passenger locations inside this aircraft during normal flight operations. Data are reported for seven locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, USAF Bioenvironmental Noise Data Handbook, Vol. 1: Organization, Content and Application, AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. GRA

N83-17247# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio. Biodynamic Environment Branch.

USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK. VOLUME 152: C-12A IN-FLIGHT CREW NOISE

H. K. HILLE Sep. 1982 18 p refs

(Contract AF PROJ. 7231)

(AD-A120509; AMRL-TR-75-50-VOL-152) Avail: NTIS HC A02/MF A01 CSCL 01B

The C-12A is a military version of the Beechcraft Super King Air 200. This report provides measured data defining the bioacoustic environments at flight crew/passenger locations inside this aircraft during normal flight operations. Data are reported for five locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times for total daily exposure of personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, USAF Bioenvironmental Noise Data Handbook, Vol 1: Organization, Content and Application, AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. GRA

N83-18404*# Wyle Labs., Inc., El Segundo, Calif.

A PILOT STUDY OF HUMAN RESPONSE TO GENERAL AVIATION AIRCRAFT NOISE Final Report

J. STEARNS, R. BROWN, and P. NEISWANDER Hampton, Va. NASA. Langley Research Center Jan. 1983 100 p refs

(Contract NAS1-15388)

(NASA-CR-166053; NAS 1.26:166053; WR-82-24) Avail: NTIS HC A05/MF A01 CSCL 20A

A pilot study, conducted to evaluate procedures for measuring the noise impact and community response to general aviation aircraft around Torrance Municipal Airport, a typical large GA airport, employed Torrance Airport's computer-based aircraft noise

monitoring system, which includes nine permanent monitor stations surrounding the airport. Some 18 residences near these monitor stations were equipped with digital noise level recorders to measure indoor noise levels. Residents were instructed to fill out annoyance diaries for periods of 5-6 days, logging the time of each annoying aircraft overflight noise event and judging its degree of annoyance on a seven-point scale. Among the noise metrics studied, the differential between outdoor maximum A-weighted noise level of the aircraft and the outdoor background level showed the best correlation with annoyance; this correlation was clearly seen at only high noise levels. And was only slightly better than that using outdoor aircraft noise level alone. The results indicate that, on a national basis, a telephone survey coupled with outdoor noise measurements would provide an efficient and practical means of assessing the noise impact of general aviation aircraft. A.R.H.

N83-18405* National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

AIRCRAFT TURBOFAN NOISE

J. F. GROENEWEG and E. J. RICE 1983 17 p refs Presented at the 28th Ann. Intern. Gas Turbine Conf., Phoenix, Ariz., 27-31 Mar. 1983

(NASA-TM-83317; E-1510; NAS 1 15:83317) Avail: NTIS HC A02/MF A01 CSCL 20A

Turbofan noise generation and suppression in aircraft engines are reviewed. The chain of physical processes which connect unsteady flow interactions with fan blades to far field noise is addressed. Mechanism identification and description, duct propagation, radiation and acoustic suppression are discussed. The experimental technique of fan inflow static tests are discussed. Rotor blade surface pressure and wake velocity measurements aid in the determination of the types and strengths of the generation mechanisms. Approaches to predicting or measuring acoustic mode content, optimizing treatment impedance to maximize attenuation, translating impedance into porous wall structure and interpreting far field directivity patterns are illustrated by comparisons of analytical and experimental results. The interdependence of source and acoustic treatment design to minimize far field noise is emphasized. Area requiring further research are discussed and the relevance of aircraft turbofan results to quieting other turbomachinery installations is addressed. S.L.

A83-21547

PROBLEMS OF REPRESENTATION OF AIR TRAFFIC CONTROLLERS IN MID-AIR LITIGATION

C. HATFIELD (U.S. Department of Justice, Civil Div., Washington, DC) Journal of Air Law and Commerce, vol. 48, Fall 1982, p. 1-21. refs

The various types of responsibility attributable to the United States for midair collision and the difficulties encountered in defending air traffic controllers involved in such accidents are discussed. The scope of the duties and responsibilities of air traffic controllers in avoiding midair collisions that occur under Instrument Flight Rules conditions are addressed, including the separation of aircraft as a primary duty and the Air Traffic Control Manual's definition of the controller's duty to separate aircraft. Then, the liability of controllers for midair collision occurring in a Terminal Control Area or a Terminal Radar Service Area is considered. Finally, the scope of the duties and responsibilities of controllers to prevent midair collisions under Visual Flight Rules are treated. Throughout, case facts and law are illustratively cited. C.D.

N83-17468# Eastern Air Lines, Inc., Atlanta, Ga.

A PRACTICAL ECONOMIC CRITERION FOR FUEL CONSERVATION

D. R. FERGUSON In DOE Symp. on Com. Aviation Energy Conserv. Strategies p 259-280 Apr. 1981

Avail: NTIS HC A17/MF A01 CSCL 01B

A method to determine the value of time to input into the least cost method of computer flight planning that will optimize the fuel time tradeoffs available over the planning time horizon is proposed. Fuel can be saved by flying the aircraft at slower speeds, however, there is an economic penalty in pursuing this policy to its ultimate limit. No policy decision can possibly encompass all the variables of temperature, wind, wind gradients and payload encountered by the thousands of flights operations. The computer flight plan systems to optimize each flight for the variables of wind, wind gradient, temperature and payload, but can not resolve the value of time to use that allows the computer to optimize each flight consistently and correctly. E.A.K.

17

SOCIAL SCIENCES

Includes social sciences (general); administration and management; documentation and information science; economics and cost analysis; law and political science; and urban technology and transportation.

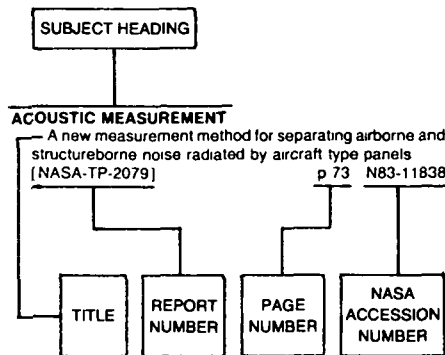
A83-20647#

USAF'S DESIGN GUIDE COMING OUT NEXT MONTH

B. R. NOTON (Batelle Columbus Laboratories, Columbus, OH) Astronautics and Aeronautics, vol. 21, Feb. 1983, p. 47-53.

Features of the USAF Manufacturing Cost/Design Guide, soon to be issued to defense suppliers, are discussed. The Guide defines techniques for cost reduction in the design and manufacturing process. Relative and quantitative comparisons of manufacturing processes, increased emphasis on cost in all design phases, cost trade-offs in airframe and electronic performance and manufacturing, savings through the use of new materials and manufacturing methods, and the application of CAM techniques are detailed. The Guide has already served for cost-effective purchases of forgings, castings, and extrusions. Average industry data are provided, including the man-hours per part and the benefits of a team approach in the design process. A restricted section of the Guide is available to manufacturers who satisfy the U.S. Export Control Regulations. D.H.K.

Typical Subject Index Listing



The subject heading is a key to the subject content of the document. The title is used to provide a description of the subject matter. When the title is insufficiently descriptive of the document content, the title extension is added, separated from the title by three hyphens. The (NASA or AIAA) accession number and the page number are included in each entry to assist the user in locating the abstract in the abstract section. If applicable, a report number is also included as an aid in identifying the document. Under any one subject heading, the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

A

A-10 AIRCRAFT

Analysis of target coverage for an unstabilized 35 mm panoramic strike camera p 231 A83-22596

A-7 AIRCRAFT

Damage tolerance assessment of the A-7D aircraft structure p 204 A83-21771

The A-7E software requirements document Three years of change data [AD-A121602] p 237 N83-18322

ACCELERATION (PHYSICS)

Gyroscopic instruments and their application to flight testing [AGARD-AG-160-VOL-15] p 233 N83-17855

ACCELERATION PROTECTION

Studies on an acceleration platform and at the time of a simulated crash of helicopter antichase seats p 197 A83-22976

ACCIDENT PREVENTION

Maintenance of airport visual aid facilities Advisory circular [AC-150-5340-26] p 219 N83-16352

ACOUSTIC ATTENUATION

Theoretical and experimental evaluation of transmission loss of cylinders — as idealized aircraft fuselages p 237 A83-19808

Eigenfunctions for liners in uniform mean flow ducts p 237 A83-19810

ACOUSTIC DUCTS

Eigenfunctions for liners in uniform mean flow ducts p 237 A83-19810

ACOUSTIC EXCITATION

Effect of excitation on coaxial jet noise p 237 A83-19811

ACOUSTIC FATIGUE

Sonic fatigue of advanced composite panels in thermal environments p 224 A83-22166

ACOUSTIC PROPAGATION

Acoustic environment in large enclosures with a small opening exposed to flow p 237 A83-22161

ACOUSTICS

Activities report of the French aerospace and research industry p 221 N83-17564

ACTIVE CONTROL

Survey of active and passive means to reduce rotorcraft vibrations [MBB-UD-350] p 206 N83-16335

Benefits assessment of active control technology and related cockpit technology for rotorcraft [NASA-CR-166406] p 217 N83-17553

ACTUATORS

Fiber optics for aircraft engine/inlet control p 211 A83-22494

ADAPTIVE CONTROL

Adaptive detection of targets in laser speckle noise p 208 A83-22521

ADHESIVE BONDING

A sensible approach to process control of adhesive bonding p 185 A83-20432

Effect of moisture on adhesively bonded titanium structures p 222 A83-20442

The effect of primer-adhesive compatibility on adhesive peel strength at low temperature p 222 A83-20448

Service history of phosphoric acid anodized aluminum structure — with adhesive bonding for aircraft construction p 185 A83-20479

Primary bonded aircraft wing construction p 186 A83-20493

Aging and performance of structural film adhesives I - A comparison of two high-temperature curing, epoxy-based systems p 223 A83-21048

AERIAL PHOTOGRAPHY

Analysis of target coverage for an unstabilized 35 mm panoramic strike camera p 231 A83-22596

AERIAL RECONNAISSANCE

Advanced tactical air reconnaissance system p 186 A83-22575

Real-time reconnaissance - A systems look at advanced technology p 200 A83-22576

Reconnaissance of the year 2000 and beyond p 186 A83-22577

Future trends in the use of infrared line scanners for airborne reconnaissance p 209 A83-22578

Stimulus variables affecting dynamic target acquisition p 209 A83-22590

CINNA - A system for preparing reconnaissance missions p 200 A83-22591

Observations of optical lightning emissions from above thunderstorms using U-2 aircraft p 234 A83-22703

AERIAL RUDDERS

A limited study of thrust vector control with guide vanes and jet rudder [FOA-C-20455-E3] p 221 N83-16386

AEROACOUSTICS

Acoustic environment in large enclosures with a small opening exposed to flow p 237 A83-22161

Comparison of forward flight effects theory of A Michalke and U Michel with measured data [NASA-CR-3665] p 238 N83-17239

AERODYNAMIC BALANCE

Unbalance response analysis of a complete turbomachine p 228 A83-19674

F-104 CCV research flight test program p 215 A83-20074

AERODYNAMIC CHARACTERISTICS

A test stand for studying transient phenomena in aerodynamic turbomachine cascades p 218 A83-20913

Effective aerodynamic parameter evaluation from free flight tests p 203 A83-21005

Numerical calculations of nonlinear aerodynamics of wing-body configurations p 189 A83-21022

Curved lifting-line theory for thin planar wings p 189 A83-21024

Wind tunnel investigation of the transonic aerodynamic characteristics of forward swept wings — supersonic cruise aircraft research p 190 A83-22153

Acoustic environment in large enclosures with a small opening exposed to flow p 237 A83-22161

Low-speed aerodynamic characteristics of a 17-percent-thick medium speed airfoil designed for general aviation applications [NASA-TP-1786] p 191 N83-16290

The calculation of separated flow at helicopter bodies [NASA-TM-76715] p 191 N83-16291

A laboratory method for the analysis of helicopter underslung load oscillations [BU-273] p 192 N83-16303

An investigation and comparison of the aerodynamic performance of selected hang-glider airfoil sections [BU-276] p 192 N83-16305

The half-model technique in the wind tunnel and its employment in the development of the airbus family [NASA-TM-76970] p 205 N83-16328

Energy efficient engine Fan test hardware detailed design report [NASA-CR-165148] p 212 N83-16341

Fuel conservation techniques in jet transport aircraft operations p 198 N83-17463

Slideslip indication system p 210 N83-17466

Representation of airfoil behaviour p 192 N83-17472

Aeroelastic equilibrium of an helicopter rotor with nonlinear aerodynamic forces p 235 N83-17482

The development of a system for interdisciplinary analysis of rotorcraft flight characteristics p 236 N83-17485

Effect of external stores on the stability and control characteristics of a delta wing fighter model at Mach numbers from 0.60 to 2.01 [NASA-TM-84596] p 194 N83-17508

Simplified free wake analysis for rotors [FFA-TN-1982-07] p 195 N83-17518

General purpose flight simulation program (FSPK-1) Part 1 Contents of the program [NAL-TR-702] p 207 N83-17529

The JT8D and JT9D engine component improvement Performance improvement program [NASA-CR-167965] p 214 N83-17543

Aerodynamic effect of a honeycomb rotor tip shroud on a 50.8-centimeter-tip-diameter core turbine [NASA-TP-2112] p 215 N83-17547

AERODYNAMIC COEFFICIENTS Analysis of oscillatory motion of a light airplane at high values of lift coefficient [NASA-TM-84563] p 216 N83-17550

AERODYNAMIC CONFIGURATIONS Computer-enhanced analysis of a jet in a cross stream p 228 A83-19804

The role of analysis in the aerodynamic design of advanced rotors p 192 N83-17471

The JT8D and JT9D engine component improvement Performance improvement program [NASA-CR-167965] p 214 N83-17543

User's manual for master Modeling of aerodynamic surfaces by 3-dimensional explicit representation — input to three dimensional computational fluid dynamics [NASA-CR-166056] p 236 N83-18304

AERODYNAMIC DRAG A study of optimum cowl shapes and flow port locations for minimum drag with effective engine cooling, volume 1 [NASA-CR-159379] p 191 N83-16288

AERODYNAMIC FORCES Application of the matrix method of forces for the calculation of aircraft structures p 232 A83-23221

Development of the basic methods needed to predict helicopters' aeroelastic behaviour [ONERA, TP NO 1982-75] p 232 A83-23248

Wind tunnel force and pressure tests [NASA-CR-3439] p 190 N83-16287

First results for the definition of a general rotorcraft dynamic program p 236 N83-17483

AERODYNAMIC INTERFERENCE The transonic wind tunnel Braunschweig of DFVLR p 217 A83-19663

Theory of resistance interference of airfoil wings and engine exhaust p 188 A83-19667

Fuselage-lifting surfaces interaction in unsteady subsonic flow — French thesis p 189 A83-22093

AERODYNAMIC LOADS

Studies on blade-to-blade and rotor-fuselage-tail interferences p 193 N83-17479
Rotor-fuselage interference on engine internal aerodynamics in maneuvering high-speed rotorcraft p 193 N83-17480

AERODYNAMIC LOADS

Prediction of the aerodynamic loads on helicopter blades in hovering and axial flight using lifting line theory p 189 N83-21016

Blade loading and rotation effects on compressor rotor wake near end walls p 190 N83-22138
The simulation of fatigue loads in aeronautics p 219 N83-23241

Prediction of Aerodynamic Loads on Rotorcraft — helicopter and wind turbine rotors [AGARD-CP-334] p 188 N83-17470

AERODYNAMIC NOISE

Radiation from a double layer jet — aerodynamic noise p 237 N83-20364
Conventional profile coaxial jet noise prediction p 237 N83-22128

AERODYNAMIC STABILITY

Dynamic stability of a buoyant quad-rotor aircraft p 216 N83-22160

Dynamic structural aeroelastic stability testing of the XV-15 tilt rotor research aircraft [NASA-TM-84293] p 216 N83-16349

AERODYNAMICS

Certain effects and paradoxes in aerodynamics and hydraulics — Russian book p 229 N83-20379
Comparison of rotor analysis results with aerodynamic windtunnel data p 194 N83-17487

Development of aerodynamic prediction methods for irregular planform wings [NASA-CR-3664] p 195 N83-17515

AEROELASTICITY

Flutter of orthotropic panels in supersonic flow using affine transformations p 228 N83-19821
A test stand for studying transient phenomena in aerodynamic turbomachine cascades p 218 N83-20913

The aeroelastic behavior of curved helicopter blades in hovering and axial flight p 203 N83-21017

Design, analyses, and model tests of an aeroelastically tailored lifting surface p 204 N83-22155

Development of the basic methods needed to predict helicopters' aeroelastic behaviour [ONERA, TP NO 1982-75] p 232 N83-23248

Survey of active and passive means to reduce rotorcraft vibrations [MBB-UD-350] p 206 N83-16335

Dynamic structural aeroelastic stability testing of the XV-15 tilt rotor research aircraft [NASA-TM-84293] p 216 N83-16349

Aeroelastic equilibrium of an helicopter rotor with nonlinear aerodynamic forces p 235 N83-17482

The estimation method on flutter boundary from subcritical random responses due to air turbulences Problems of test procedures and data analysis [NAL-TR-718] p 217 N83-17554

AERONAUTICAL ENGINEERING

Aeronautical research and technology policy Volume 1 Summary report p 187 N83-17452

Activities report of the French aerospace and research industry p 221 N83-17564

Manufacturing processes for aeronautical structures p 227 N83-17620

A study of real-time computer graphic display technology for aeronautical applications [NASA-CR-169828] p 236 N83-18307

AERONAUTICS

Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers p 186 N83-21001

AEROSPACE ENGINEERING

Specific examples of aerospace applications of composites p 227 N83-17621

AEROSPACE INDUSTRY

The development of standards for the common ICAO Data Interchange Network /CIDIN/ p 230 N83-22027

Aeronautical research and technology policy Volume 1 Summary report p 187 N83-17452

AEROSPACE MEDICINE

USAF Environmental Noise Data Handbook. Volume 150. C-140 in-flight crew noise [AD-A120508] p 238 N83-17246

USAF Bioenvironmental Noise Data Handbook. Volume 152. C-12A in-flight crew noise [AD-A120509] p 238 N83-17247

Human Factors Aspects of Aircraft Accidents [AGARD-LS-125] p 188 N83-17490

AEROSPACE SYSTEMS

Technical and secretariat support of the MIL-STD-1515 fastener standardization effort [AD-A119828] p 232 N83-16760

AEROSPACE VEHICLES

The ideas of F. A. Tsander and an assessment of the application of jet engines for the acceleration of aerospace vehicles p 221 N83-22657

AEROTHERMODYNAMICS

Improved fault detection in the hot section of turbojet engines by individual monitoring procedures p 210 N83-19666

AGING (MATERIALS)

Aging and performance of structural film adhesives I - A comparison of two high-temperature curing, epoxy-based systems p 223 N83-21048

AGRISTARS PROJECT

Program to compute the positions of the aircraft and of the aircraft sensor footprints [E83-10139] p 234 N83-16814

AILERONS

Wind tunnel force and pressure tests [NASA-CR-163109] p 190 N83-16287

AIR CARGO

Sandia Aircraft Crashfire Facility [DE82-004297] p 198 N83-16313

AIR COOLING

Evaluation of air-cooled Si3N4 vanes p 224 N83-22263

Features of the selection of the basic parameters of cooled GTE turbines p 211 N83-22655

AIR FLOW

Flight evaluation of an engine static pressure noseprobe in an F-15 airplane [NASA-CR-163109] p 214 N83-17546

AIR INTAKES

On the choice of the optimal total wedge angle for the air intake of a hypersonic ramjet engine p 212 N83-22656

AIR LAW

Problems of representation of air traffic controllers in mid-air litigation p 239 N83-21547

AIR NAVIGATION

Lasers in aviation — Russian book p 229 N83-20384

Suboptimal filters for INS alignment on a moving base p 199 N83-21019

CINNA - A system for preparing reconnaissance missions p 200 N83-22591

Oceanic Area System Improvement Study (OASIS) Volume 1 Executive summary and improvement alternatives development and analysis [FAA-EM-81-17-VOL-1] p 200 N83-16314

Oceanic Area System Improvement Study (OASIS) Volume 2 North Atlantic region air traffic services system description [FAA-EM-81-17-VOL-2] p 201 N83-16315

Oceanic Area System Improvement Study (OASIS) Volume 3 Central East Pacific region air traffic services system description [FAA-EM-81-17-VOL-3] p 201 N83-16316

Oceanic Area System Improvement Study (OASIS) Volume 4 Caribbean region air traffic services system description [FAA-EM-81-17-VOL-4] p 201 N83-16317

Radio navigation and airplane navigation [AD-A120595] p 202 N83-16325

AIR POLLUTION

Composite design of an advanced airborne monitoring system [DE82-006980] p 235 N83-18106

AIR SAMPLING

Composite design of an advanced airborne monitoring system [DE82-006980] p 235 N83-18106

AIR TO AIR MISSILES

Thirty years of fighter armament p 203 N83-20600

B-52 roles in sea control p 186 N83-20646

AIR TRAFFIC CONTROL

Performance analysis of a dwell-time processor for monopulse beacon radars p 200 N83-22726

Reply correlation test analysis in monopulse beacon radars p 200 N83-22727

Oceanic Area System Improvement Study (OASIS) Volume 1 Executive summary and improvement alternatives development and analysis [FAA-EM-81-17-VOL-1] p 200 N83-16314

Oceanic Area System Improvement Study (OASIS) Volume 2 North Atlantic region air traffic services system description [FAA-EM-81-17-VOL-2] p 201 N83-16315

Oceanic Area System Improvement Study (OASIS) Volume 3 Central East Pacific region air traffic services system description [FAA-EM-81-17-VOL-3] p 201 N83-16316

Oceanic Area System Improvement Study (OASIS) Volume 4 Caribbean region air traffic services system description [FAA-EM-81-17-VOL-4] p 201 N83-16317

Oceanic Area System Improvement Study (OASIS) Volume 5 North Atlantic, Central East Pacific, and Caribbean regions communication systems description [FAA-EM-81-17-VOL-5] p 201 N83-16318

Oceanic Area System Improvement Study (OASIS) Volume 7 North Atlantic region flight cost model results [FAA-EM-81-17-VOL-7] p 201 N83-16319

Oceanic Area System Improvement Study (OASIS) Volume 8 Central East Pacific region flight cost model results [FAA-EM-81-17-VOL-8] p 201 N83-16320

Oceanic Area System Improvement Study (OASIS) Volume 9 Flight cost model description [FAA-EM-81-17-VOL-9] p 201 N83-16321

Oceanic Area System Improvement Study (OASIS) Volume 10 North Atlantic, Central East Pacific, and Caribbean regions aviation traffic forecasts [FAA-EM-81-17-VOL-10] p 201 N83-16322

Conflict monitoring analysis of parallel opposite direction routes, volume 2 [AD-A120187] p 202 N83-16323

Air traffic control Its effect on fuel conservation p 202 N83-17464

Mode S baseline radar tracking [FAA-RD-82-53] p 233 N83-17770

AIR TRAFFIC CONTROLLERS (PERSONNEL)

Problems of representation of air traffic controllers in mid-air litigation p 239 N83-21547

AIR TRANSPORTATION

The development of standards for the common ICAO Data Interchange Network /CIDIN/ p 230 N83-22027

AIRBORNE EQUIPMENT

Graphite/epoxy material characteristics and design techniques for airborne instrument application p 225 N83-22595

Observations of optical lightning emissions from above thunderstorms using U-2 aircraft p 234 N83-22703

Spatial calibration of a multispectral data base — of airborne scanner systems p 209 N83-22882

AIRBORNE SURVEILLANCE RADAR

Advanced tactical air reconnaissance system p 186 N83-22575

AIRBORNE/SPACEBORNE COMPUTERS

The automated cockpit p 208 N83-20849

The software-implemented fault tolerance /SIFT/ approach to fault tolerant computing p 235 N83-22825

Computer-generated images in visual simulation and avionics technologies p 219 N83-22835

The on-board computer system for the F29 prototype flight test [NLR-MP-81034-U] p 209 N83-16339

Computers in avionics systems [NLR-MP-81063-U] p 236 N83-18291

AIRCRAFT ACCIDENT INVESTIGATION

Aircraft accident survivors as witnesses p 196 N83-20788

Human Factors Aspects of Aircraft Accidents [AGARD-LS-125] p 188 N83-17490

An overview of human factors in aircraft accidents and investigative techniques p 198 N83-17491

AIRCRAFT ACCIDENTS

Problems of representation of air traffic controllers in mid-air litigation p 239 N83-21547

Aircraft accident report. Sun West Airlines Flight 104, Piper PA-31-350(T-1020), N41070, Durango-LaPlata County Airport, Durango, Colorado, December 31, 1981 [PB82-910413] p 197 N83-16309

Sandia Aircraft Crashfire Facility [DE82-004297] p 198 N83-16313

Human Factors Aspects of Aircraft Accidents [AGARD-LS-125] p 188 N83-17490

An overview of human factors in aircraft accidents and investigative techniques p 198 N83-17491

The engineering investigation of aircraft accidents p 198 N83-17497

AIRCRAFT CARRIERS

CTOL, STOAL, V/STOL - An operational companion for forward deployed CVNs p 196 N83-22157

Performance measures for aircraft carrier landings as a function of aircraft dynamics [AD-A120473] p 206 N83-16334

AIRCRAFT COMMUNICATION

USAF ground fiber optic development program p 228 N83-19711

Obscuration by helicopter-produced snow clouds p 197 N83-22357

Oceanic Area System Improvement Study (OASIS) Volume 1 Executive summary and improvement alternatives development and analysis [FAA-EM-81-17-VOL-1] p 200 N83-16314

Oceanic Area System Improvement Study (OASIS) Volume 2 North Atlantic region air traffic services system description [FAA-EM-81-17-VOL-2] p 201 N83-16315

SUBJECT INDEX

- Oceanic Area System Improvement Study (OASIS)
Volume 3 Central East Pacific region air traffic services
system description p 201 N83-16316
[FAA-EM-81-17-VOL-3]
- Oceanic Area System Improvement Study (OASIS)
Volume 4 Caribbean region air traffic services system
description p 201 N83-16317
[FAA-EM-81-17-VOL-4]
- Oceanic Area System Improvement Study (OASIS)
Volume 5 North Atlantic, Central East Pacific, and
Caribbean regions communication systems description
[FAA-EM-81-17-VOL-5] p 201 N83-16318
- AIRCRAFT COMPARTMENTS**
In-flight aircraft seat fire extinguishing tests (cabin hazard
measurements) p 197 N83-16308
[FAA-CT-82-111]
- AIRCRAFT CONFIGURATIONS**
The Hummercraft p 204 A83-21033
Helicopter fin effectiveness
[BU-271] p 206 N83-16336
- AIRCRAFT CONSTRUCTION MATERIALS**
A new high impact resin system for advanced
composites with 300 F /150 C/ properties p 222 A83-20429
The development of advanced composite front fuselage
technology p 202 A83-20464
Service history of phosphoric acid anodized aluminum
structure -- with adhesive bonding for aircraft
construction p 185 A83-20479
Damage tolerance and reparability of advanced
composite structures p 222 A83-20484
Advanced composite materials in aerobatic aircraft
p 203 A83-20496
Design considerations for the construction of a Sherriff
wing in composite materials p 206 N83-16337
[BU-280]
Repair techniques for graphite/epoxy structures for
commercial transport applications p 225 N83-16397
[NASA-CR-159056]
Practical Considerations of Design, Fabrication and
Tests for Composite Materials p 227 N83-17609
[AGARD-LS-124]
The nature of fibre composite materials p 227 N83-17610
- AIRCRAFT CONTROL**
Extended perfect model following -- control system
synthesis technique p 235 A83-20289
Application of vector performance optimization to a
robust control loop design for a fighter aircraft
p 215 A83-21160
Realistic 'feel' in flight simulators is based on precise
control loading p 219 A83-23240
Distributed micro-processor applications to guidance
and control systems p 236 N83-18295
[AGARD-AR-178]
- AIRCRAFT DESIGN**
Theory of resistance interference of airfoil wings and
engine exhaust p 188 A83-19667
A superelement analysis of stiffened shells -- Russian
book on aircraft fuselage structures p 202 A83-20392
Curvature transitions of composite curves and surfaces
-- Questions regarding details of computer-aided design
-- German thesis p 235 A83-20398
The development of advanced composite front fuselage
technology p 202 A83-20464
Advanced composite materials in aerobatic aircraft
p 203 A83-20496
The future for fighter aircraft p 186 A83-20597
Technology and modern fighter aircraft - The
evolutionary F-16 p 203 A83-20598
NGT - The Next Generation Trainer p 203 A83-20599
Thirty years of fighter armament p 203 A83-20600
USAF's design guide coming out next month
p 239 A83-20647
Operator influences on aircraft design p 204 A83-21032
Design, analyses, and model tests of an aeroelastically
tailored lifting surface p 204 A83-22155
Analysis of aero-optic interface phenomena p 190 A83-22588
Initial design of stringer stiffened bend boxes using
geometric programming p 232 A83-23149
Naval Airship Program for Sizing and Performance
(NAPSAP), computer program development Program
update number 2 p 191 N83-16293
[AD-A120830]
Flying and design of aircraft p 205 N83-16326
[RAE-TRANS-2070]
The half-model technique in the wind tunnel and its
employment in the development of the Airbus family
[NASA-TM-76970] p 205 N83-16328
Design considerations for the construction of a Sherriff
wing in composite materials p 206 N83-16337
[BU-280]
- Turbine engine fuel conservation by fan and compressor
profile control p 213 N83-17467
- AIRCRAFT ENGINES**
Fabrication technology for aircraft engines -- Russian
book p 185 A83-20381
Automated machining of turbine blades by
Rolls-Royce p 229 A83-21348
Cleaning gas turbine compressors - Some service
experience with a wet-wash system p 210 A83-21350
The corrosion resistance of protective coatings
p 223 A83-21454
Fatigue failure under fretting conditions p 224 A83-21481
Internal performance prediction for advanced exhaust
systems -- for tactical aircraft p 211 A83-22156
Compact installation for testing vectored-thrust
engines p 218 A83-22158
High bypass ratio engine noise component separation
by coherence technique p 211 A83-22159
Advances in high-speed rolling-element bearings -- for
aircraft engine and transmission application p 231 A83-22319
Fiber optics for aircraft engine/inlet control p 211 A83-22494
Theory and design of flight-vehicle engines -- Russian
book p 211 A83-22651
Current problems in the testing of aircraft engines
p 211 A83-22652
Errors in the experimental determination of the
parameters of supersonic combustion ramjet engines
p 211 A83-22653
The effect of the nonuniformity of supersonic flow with
shocks on friction and heat transfer in the channel of a
hypersonic ramjet engine p 211 A83-22654
Features of the selection of the basic parameters of
cooled GTE turbines p 211 A83-22655
On the choice of the optimal total wedge angle for the
air intake of a hypersonic ramjet engine p 212 A83-22656
Numerical calculation of the separation and connection
of two-dimensional supersonic flows in channels with
discontinuous boundaries p 212 A83-22658
Gas turbine combustor modelling for calculating
pollutant emission p 212 A83-23142
Design of an integrated control system for a supersonic
aircraft power plant p 212 A83-23175
PW 4000 - A radically new jet engine being developed
in the USA p 212 A83-23239
Energy efficient engine Fan test hardware detailed
design report p 212 N83-16341
[NASA-CR-165148]
A method to estimate weight and dimensions of small
aircraft propulsion gas turbine engines User's guide
[NASA-CR-168049] p 213 N83-16343
Blade erosion effects on aircraft-engine compressor
performance p 213 N83-16346
[DE82-021791]
Vibration-free internal combustion engine for general
aviation p 213 N83-16347
[BMFT-FB-W-82-016]
Materials screening tests of the FOD impact design
technology program, task 4C -- fan and compressor blades
for aircraft engines p 225 N83-16401
[AD-A119839]
Effects of flight on noise radiated from convected ring
sources in coaxial dual flow Part 2 The noise from
heated jets p 238 N83-17237
[NASA-CR-169736]
Effects of noise radiated from convected ring sources
in coaxial dual flow Part 1 The noise from unheated
jets p 238 N83-17238
[NASA-CR-169737]
The J79D Jet Engine Diagnostics Program p 214 N83-17544
[NASA-CR-167966]
Study of advanced rotary combustion engines for
commuter aircraft p 214 N83-17545
[NASA-CR-165399]
Bearing fatigue investigation 3 p 233 N83-17880
[NASA-CR-168029]
Creep and fatigue interactions in a nickel base
superalloy p 234 N83-17903
[NLR-MP-82003-U]
Aircraft turbofan noise p 239 N83-18405
[NASA-TM-83317]
- AIRCRAFT EQUIPMENT**
Electrical, avionics, and sensor equipment of the Yak-40
aircraft /2nd revised and enlarged edition/ -- Russian
book p 208 A83-20390
- AIRCRAFT FUELS**
Fuel for future transport aircraft p 222 A83-20082
Effect of broad properties fuel on injector performance
in a reverse flow combustor p 210 A83-21079
[AIAA PAPER 83-0154]
Sandia Aircraft Crashfire Facility p 198 N83-16313
[DE82-004297]
- Symposium on Commercial Aviation Energy
Conservation Strategies Papers and presentations
[AD-A107106] p 188 N83-17455
Development of a procedure for calculating the effects
of airfoil erosion on aircraft engine compressor
performance p 213 N83-17457
Aircraft towing feasibility study p 207 N83-17458
An overview of the DOT/FAA aviation energy
conservation policy p 235 N83-17460
Flight preparation and planning p 188 N83-17462
Equivalency evaluation of firefighting agents and
minimum requirements at US Air Force airfields
[FAA-CT-82-109] p 198 N83-17524
Experimental study of the thermal stability of
hydrocarbon fuels p 228 N83-17728
[NASA-CR-168027]
- AIRCRAFT GUIDANCE**
Automation of on-board flightpath management
p 215 A83-21002
An on-board near-optimal climb-dash energy
management p 205 N83-16329
[NASA-CR-169755]
Results from tests, with van-mounted sensor, of
magnetic leader cable for aircraft guidance during roll-out
and turnoff p 209 N83-16338
[NASA-TP-2092]
Distributed micro-processor applications to guidance
and control systems p 236 N83-18295
[AGARD-AR-178]
- AIRCRAFT HAZARDS**
Remote sensing of problem birds in aviation
p 196 A83-21876
Management of bird problem in Indian airlines
p 196 A83-21877
Bird strikes to aircraft and associated hazards and
problems regarding the safety of aircraft operations
p 196 A83-21878
Sandia Aircraft Crashfire Facility p 198 N83-16313
[DE82-004297]
Equivalency evaluation of firefighting agents and
minimum requirements at US Air Force airfields
[FAA-CT-82-109] p 198 N83-17524
- AIRCRAFT INSTRUMENTS**
Microwave Ice Accretion Measurement Instrument
/MIAMI/ p 208 A83-22163
Calibration support of the AN/AAM-60 common
forward-looking infrared /FLIR/ test bench
p 232 A83-22886
- AIRCRAFT LANDING**
A concept for reducing helicopter IFR landing weather
minimums - Onshore p 199 A83-21034
In-flight investigation of large airplane flying qualities for
approach and landing p 206 N83-16332
[AD-A120202]
Performance measures for aircraft carrier landings as
a function of aircraft dynamics p 206 N83-16334
[AD-A120473]
- AIRCRAFT LIGHTS**
Desirable characteristics of underwater lights for
helicopter escape hatches p 197 N83-16310
[AD-A120331]
- AIRCRAFT MAINTENANCE**
Aircraft inspection using radiography p 185 A83-20478
Damage tolerance and reparability of advanced
composite structures p 222 A83-20484
Demonstration of reparability and repair quality on
graphite/epoxy structural subelements p 186 A83-20485
Elevated temperature repairs of advanced composite
structures p 223 A83-20499
Cleaning gas turbine compressors - Some service
experience with a wet-wash system p 210 A83-21350
Analysis and repair of flaws in thick structures
p 230 A83-21654
Three computer based aids to maintenance
scheduling p 187 N83-16280
[AD-A120351]
Computer based maintenance aids system Preliminary
development and evaluation of a prototype p 187 N83-16281
[AD-A120627]
Repair techniques for graphite/epoxy structures for
commercial transport applications p 225 N83-16397
[NASA-CR-159056]
Development of a procedure for calculating the effects
of airfoil erosion on aircraft engine compressor
performance p 213 N83-17457
- AIRCRAFT MANEUVERS**
Advanced composite materials in aerobatic aircraft
p 203 A83-20496
Supersonic maneuvers without superbooms p 189 A83-21021
Aircraft maneuver mechanics with turning of the
power-plant thrust vector p 216 A83-22076

AIRCRAFT MODELS

Researchers study methods to combat effects of wind shear p 196 A83-22175

AIRCRAFT NOISE

Theoretical and experimental evaluation of transmission loss of cylinders --- as idealized aircraft fuselages

p 237 A83-19808

Aerosound from corner flow and flap flow

[AIAA PAPER 81-2039] p 237 A83-19813

Airport community soundproofing and relocation study

[PB82-259144] p 220 N83-16358

Airport noise Land-use compatibility by the year 2000

[PB82-259151] p 220 N83-16359

Multiple-event airplane noise annoyance

[NASA-TP-2101] p 234 N83-16951

USAF Bioenvironmental Noise Data Handbook Volume 152: C-12A in-flight crew noise

[AD-A120509] p 238 N83-17247

The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations --- (Los Angeles)

p 202 N83-17459

Activities report of the French aerospace and research industry

p 221 N83-17564

Aircraft turbofan noise

[NASA-TM-83317] p 239 N83-18405

AIRCRAFT PARTS

Elevated temperature repairs of advanced composite structures

p 223 A83-20499

AIRCRAFT PERFORMANCE

The future for fighter aircraft p 186 A83-20597

Technology and modern fighter aircraft - The evolutionary F-16

p 203 A83-20598

NGT - The Next Generation Trainer

p 203 A83-20599

CTOL, STOAL, V/STOL - An operational comparison for forward deployed CVNs

p 196 A83-22157

The CF6 engine performance improvement

[NASA-CR-165612] p 212 N83-16342

The JT9D Jet Engine Diagnostics Program

[NASA-CR-167966] p 214 N83-17544

AIRCRAFT PRODUCTION

Plastic tooling for advanced composites

p 222 A83-20481

AIRCRAFT PRODUCTION COSTS

Will technology make the helicopter competitive

p 204 A83-21574

AIRCRAFT RELIABILITY

Aircraft inspection using radiography

p 185 A83-20478

Flight simulation test of National Aerospace Laboratory

STOL-research-aircraft Part 1 STOL configuration

[NAL-TR-713-PT-1] p 207 N83-17528

AIRCRAFT SAFETY

Flying and design of aircraft

[RAE-TRANS-2070] p 205 N83-16326

The influence of handling qualities, crashworthiness and other engineering factors on aircraft safety

p 198 N83-17493

Advanced Ultra-Violet (UV) aircraft fire detection system

Volume 1 System description and flight test

[AD-A12153] p 198 N83-17526

AIRCRAFT STRUCTURES

Effect of moisture on adhesively bonded titanium structures

p 222 A83-20442

Aircraft inspection using radiography

p 185 A83-20478

Primary bonded aircraft wing construction

p 186 A83-20493

Electrical discharge machining of aluminum honeycomb core

p 229 A83-20500

Analysis and repair of flaws in thick structures

p 230 A83-21654

Damage tolerance assessment of the A-7D aircraft structure

p 204 A83-21771

Progress in the practical applications of fracture mechanics

p 230 A83-21796

An improved methodology for predicting random spectrum load interaction effects on fatigue crack growth

p 224 A83-21802

Sonic fatigue of advanced composite panels in thermal environments

p 224 A83-22166

Eddy current impedance plane analysis

p 231 A83-22410

Initial design of stringer stiffened bend boxes using geometric programming

p 232 A83-23149

Application of the matrix method of forces for the calculation of aircraft structures

p 232 A83-23221

The simulation of fatigue loads in aeronautics

p 219 A83-23241

Composite structural materials

[NASA-CR-169859] p 226 N83-17597

AIRFOIL PROFILES

Low-speed aerodynamic characteristics of a 17-percent-thick medium speed airfoil designed for general aviation applications

[NASA-TP-1786] p 191 N83-16290

An investigation and comparison of the aerodynamic performance of selected hang-glider airfoil sections

[BU-276] p 192 N83-16305

A study of the flow around a slotted flap end

[BU-279] p 192 N83-16306

Turbine engine fuel conservation by fan and compressor profile control

p 213 N83-17467

Studies of aerofoils and blade tips for helicopters

p 193 N83-17473

AIRFOILS

The transonic wind tunnel Braunschweig of DFVLR

p 217 A83-19663

Wind tunnel force and pressure tests

[NASA-CR-3439] p 190 N83-16287

Low-speed aerodynamic characteristics of a 17-percent-thick medium speed airfoil designed for general aviation applications

[NASA-TP-1786] p 191 N83-16290

Finite difference calculation of an inviscid transonic flow over oscillating airfoils

[RAE-TRANS-2087] p 191 N83-16292

Development of a procedure for calculating the effects of airfoil erosion on aircraft engine compressor performance

p 213 N83-17457

The role of analysis in the aerodynamic design of advanced rotors

p 192 N83-17471

Representation of airfoil behaviour

p 192 N83-17472

AIRFRAMES

Potential fuel savings through improved airframe maintenance

p 188 N83-17456

AIRLINE OPERATIONS

Operator influences on aircraft design

p 204 A83-21032

The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations --- (Los Angeles)

p 202 N83-17459

AIRPORT LIGHTS

Evaluation of supplemental lights for caution bars

[FAA-CT-82-119] p 220 N83-17559

AIRPORT PLANNING

Maintenance of airport visual aid facilities Advisory circular

[AC-150-5340-26] p 219 N83-16352

The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations --- (Los Angeles)

p 202 N83-17459

Aids to decision making in airport planning

[REPT-34] p 221 N83-17562

AIRPORTS

Airport community soundproofing and relocation study

[PB82-259144] p 220 N83-16358

Equivalency evaluation of firefighting agents and minimum requirements at US Air Force airfields

[FAA-CT-82-109] p 198 N83-17524

Evaluation of supplemental lights for caution bars

[FAA-CT-82-119] p 220 N83-17559

AIRSHIPS

Naval Airship Program for Sizing and Performance (NAPSAP), computer program development. Program update number 2

[AD-A120830] p 191 N83-16293

ALUMINUM

Service history of phosphoric acid anodized aluminum structure --- with adhesive bonding for aircraft construction

p 185 A83-20479

ALUMINUM ALLOYS

Electrical discharge machining of aluminum honeycomb core

p 229 A83-20500

An improved methodology for predicting random spectrum load interaction effects on fatigue crack growth

p 224 A83-21802

ALUMINUM BORON COMPOSITES

Program for establishing long-time flight service performance of composite materials in the center wing structure of C-130 aircraft. Phase 5 Flight service and inspection

[NASA-CR-165770] p 227 N83-17600

ALUMINUM COATINGS

High temperature stability of pack aluminide coatings on IN38LC

p 230 A83-21459

AMMONIUM CHLORIDES

Optical observations of unidirectional solidification in microgravity

[NASA-TP-2110] p 225 N83-16492

ANALOG SIMULATION

Identification of certain dynamic characteristics of a helicopter-autopilot system by means of simulation

p 216 A83-23222

ANODIZING

Service history of phosphoric acid anodized aluminum structure --- with adhesive bonding for aircraft construction

p 185 A83-20479

ANTI-MISTING FUELS

Anti-misting additives for jet fuels

[NASA-CR-169751] p 225 N83-16417

Viscometric and misting properties of polymer-modified fuel

[NASA-CR-169750] p 226 N83-16543

ANTISHIP MISSILES

B-52 roles in sea control p 186 A83-20646

ANTISHIP WARFARE

B-52 roles in sea control p 186 A83-20646

APPROACH

In-flight investigation of large airplane flying qualities for approach and landing

[AD-A120202] p 206 N83-16332

APPROACH CONTROL

Aircraft accident report. Sun West Airlines Flight 104, Piper PA-31-350(T-1020), N41070, Durango-LaPlata County Airport, Durango, Colorado, December 31, 1981

[PB82-910413] p 197 N83-16309

Maintenance of airport visual aid facilities Advisory circular

[AC-150-5340-26] p 219 N83-16352

APPROACH INDICATORS

Development of the precision approach path indicator light unit

[RAE-TM-FS(B)-483] p 202 N83-17527

ARCHITECTURE (COMPUTERS)

Distributed micro-processor applications to guidance and control systems

[AGARD-AR-178] p 236 N83-18295

Microprocessor applications to guidance and control architectures

p 236 N83-18297

ARMED FORCES (UNITED STATES)

USAF's design guide coming out next month

p 239 A83-20647

AROMATIC COMPOUNDS

Sooting tendency of fuels containing polycyclic aromatics in a research combustor

p 225 A83-23138

ASTRONAUTICS

Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers

p 186 A83-21001

ATLANTIC OCEAN

Oceanic Area System Improvement Study (OASIS) Volume 2 North Atlantic region air traffic services system description

[FAA-EM-81-17-VOL-2] p 201 N83-16315

Oceanic Area System Improvement Study (OASIS) Volume 5 North Atlantic, Central East Pacific, and Caribbean regions communication systems description

[FAA-EM-81-17-VOL-5] p 201 N83-16318

Oceanic Area System Improvement Study (OASIS) Volume 7 North Atlantic region flight cost model results

[FAA-EM-81-17-VOL-7] p 201 N83-16319

Oceanic Area System Improvement Study (OASIS) Volume 9 Flight cost model description

[FAA-EM-81-17-VOL-9] p 201 N83-16321

Oceanic Area System Improvement Study (OASIS) Volume 10 North Atlantic, Central East Pacific, and Caribbean regions aviation traffic forecasts

[FAA-EM-81-17-VOL-10] p 201 N83-16322

ATMOSPHERIC ATTENUATION

Obscuration by helicopter-produced snow clouds

p 197 A83-22357

ATMOSPHERIC CHEMISTRY

Composite design of an advanced airborne monitoring system

[DE82-006980] p 235 N83-18106

ATMOSPHERIC COMPOSITION

Activities report of the French aerospace and research industry

p 221 N83-17564

ATMOSPHERIC EFFECTS

Supersonic maneuvers without superbooms

p 189 A83-21021

ATMOSPHERIC OPTICS

Analysis of aero-optic interface phenomena

p 190 A83-22588

Observations of optical lightning emissions from above thunderstorms using U-2 aircraft

p 234 A83-22703

ATMOSPHERIC TURBULENCE

A simulation model for the analysis of the dynamic behavior of a helicopter rotor under nonstationary limit flight conditions

p 204 A83-23220

The estimation method on flutter boundary from subcritical random responses due to air turbulences

Problems of test procedures and data analysis

[NAL-TR-718] p 217 N83-17554

ATTITUDE (INCLINATION)

Gyroscopic instruments and their application to flight testing

[AGARD-AG-160-VOL-15] p 233 N83-17855

ATTITUDE CONTROL

Evaluation of helicopter pilot's attitude control using a simulated head-up display in a simulated helicopter cockpit

[AD-A119570] p 219 N83-16355

AUDITORY STIMULI

Multiple-event airplane noise annoyance

[NASA-TP-2101] p 234 N83-16951

AUTOCLAVING

Manufacturing processes for aeronautical structures
p 227 N83-17620

AUTOMATED RADAR TERMINAL SYSTEM

Mode S baseline radar tracking
[FAA-RD-82-53] p 233 N83-17770

AUTOMATIC CONTROL

Automated machining of turbine blades by
Rolls-Royce p 229 A83-21348

AUTOMATIC FLIGHT CONTROL

The automated cockpit p 208 A83-20849
Automation of on-board flightpath management
p 215 A83-21002

Application of vector performance optimization to a
robust control loop design for a fighter aircraft
p 215 A83-21160

The software-implemented fault tolerance /SIFT/
approach to fault tolerant computing p 235 A83-22825

AUTOMATIC PILOTS

Identification of certain dynamic characteristics of a
helicopter-autopilot system by means of simulation
p 216 A83-23222

AUTOMATIC TEST EQUIPMENT

Electro-optical calibration considerations at intermediate
maintenance levels p 232 A83-22883

AVIONICS

Electrical, avionic, and sensor equipment of the Yak-40
aircraft /2nd revised and enlarged edition/ — Russian
book p 208 A83-20390

Fiber optic wavelength multiplexing for civil aviation
applications p 208 A83-22492

Computer-generated images in visual simulation and
avionic technologies p 219 A83-22835

ATR 42 will have ultramodern, innovative cockpit,
avionics p 208 N83-17759

Computers in avionics systems
[NLR-MP-81063-U] p 236 N83-18291

AXIAL FLOW

Velocity coupling A new concept for hover and axial
flow wake analysis and design p 193 N83-17478

B**B-52 AIRCRAFT**

B-52 roles in sea control p 186 A83-20646

BACKSCATTERING

Laser and millimeter-wave backscatter of transmission
cables p 199 A83-22523

BALL BEARINGS

Advances in high-speed rolling-element bearings — for
aircraft engine and transmission application p 231 A83-22319

Rolling-element fatigue life of AMS 5900 balls
[NASA-TP-2080] p 232 N83-16758

BARS

Evaluation of supplemental lights for caution bars
[FAA-CT-82-119] p 220 N83-17559

BEAMS (SUPPORTS)

Equivalent G/E of helicopter rotor blades — shear
modulus to Young's modulus ratio p 230 A83-22151

BEARING (DIRECTION)

Conflict monitoring analysis of parallel opposite direction
routes, volume 2 p 202 N83-16323

BIOACOUSTICS

USAF Environmental Noise Data Handbook Volume
150 C-140 in-flight crew noise p 238 N83-17246

USAF Bioenvironmental Noise Data Handbook Volume
152 C-12A in-flight crew noise p 238 N83-17247

BIODYNAMICS

Vertical impact tests of a modified F/FB-111 crew seat
to evaluate headrest position and restraint configuration
effects p 197 N83-16311

BIRD-AIRCRAFT COLLISIONS

Remote sensing of problem birds in aviation
p 196 A83-21876

Management of bird problem in Indian airlines
p 196 A83-21877

Bird strikes to aircraft and associated hazards and
problems regarding the safety of aircraft operations
p 196 A83-21878

BLADE SLAP NOISE

Theoretical and experimental study of helicopter rotor
noise p 205 A83-23247

BLADE TIPS

Studies of aerofoils and blade tips for helicopters
p 193 N83-17473

Calculation of 3D unsteady transonic flow around rotor
blades p 193 N83-17474

An appraisal of rotor blade-tip vortex interaction and
wake geometry from flight measurements p 194 N83-17488

Aerodynamic effect of a honeycomb rotor tip shroud
on a 50.8-centimeter-tip-diameter core turbine
[NASA-TP-2112] p 215 N83-17547

BO-105 HELICOPTER

Bo 105 rotor blade influence on the Calipso FLIR in
the mast-mounted observation platform Ophelia
p 205 A83-23249

BODY-WING CONFIGURATIONS

Numerical calculations of nonlinear aerodynamics of
wing-body configurations p 189 A83-21022

Fuselage-lifting surfaces interaction in unsteady
subsonic flow — French thesis p 189 A83-22093

BOEING 727 AIRCRAFT

Researchers study methods to combat effects of wind
shear p 196 A83-22175

Advanced composite elevator for Boeing 727 aircraft,
volume 2 p 205 N83-16330

[NASA-CR-159258] p 205 N83-16330

BONDING

The electrical properties of carbon fibre composites
p 227 N83-17618

BOOMS (EQUIPMENT)

Two years of training with the first true three-dimensional
simulator p 218 A83-22833

BORON-EPOXY COMPOUNDS

Program for establishing long-time flight service
performance of composite materials in the center wing
structure of C-130 aircraft Phase 5 Flight service and
inspection p 227 N83-17600

[NASA-CR-165770] p 227 N83-17600

BOX BEAMS

Initial design of stringer stiffened bend boxes using
geometric programming p 232 A83-23149

BRIDGES (STRUCTURES)

Progress in the practical applications of fracture
mechanics p 230 A83-21796

BUTENES

Viscometric and misting properties of polymer-modified
fuel p 226 N83-16543

[NASA-CR-169750] p 226 N83-16543

C**C-130 AIRCRAFT**

Program for establishing long-time flight service
performance of composite materials in the center wing
structure of C-130 aircraft Phase 5 Flight service and
inspection p 227 N83-17600

[NASA-CR-165770] p 227 N83-17600

C-135 AIRCRAFT

Two years of training with the first true three-dimensional
simulator p 218 A83-22833

C-140 AIRCRAFT

USAF Environmental Noise Data Handbook Volume
150 C-140 in-flight crew noise p 238 N83-17246

[AD-A120508] p 238 N83-17246

CABLES (ROPES)

Results from tests, with van-mounted sensor, of
magnetic leader cable for aircraft guidance during roll-out
and turnoff p 209 N83-16338

[NASA-TP-2092] p 209 N83-16338

CALCULATORS

Planning fuel-conservative descents with or without time
constraints using a small programmable calculator
Algorithm development and flight test results p 210 N83-17535

[NASA-TP-2085] p 210 N83-17535

CALIBRATING

Infrared calibration facilities at Newark Air Force
Station p 219 A83-22875

Spatial calibration of a multispectral data base — of
airborne scanner systems p 209 A83-22882

Electro-optical calibration considerations at intermediate
maintenance levels p 232 A83-22883

Calibration support of the AN/AAM-60 common
forward-looking infrared /FLIR/ test bench p 232 A83-22886

CARBON

Evaluation of lubricants for air compressors
[PB82-259003] p 226 N83-16538

CARBON DIOXIDE LASERS

Multifunction CO₂ laser radar technology
p 208 A83-22502

CARBON FIBER REINFORCED PLASTICS

A new high impact resin system for advanced
composites with 300 F /150 C/ properties p 222 A83-20429

Service operation of a CFRP window frame in short fiber
pressing [BMFT-FB-W-82-021] p 233 N83-17749

CARBON FIBERS

The electrical properties of carbon fibre composites
p 227 N83-17618

CARIBBEAN SEA

Oceanic Area System Improvement Study (OASIS)
Volume 4 Caribbean region air traffic services system
description p 201 N83-16317

[FAA-EM-81-17-VOL-4] p 201 N83-16317

Oceanic Area System Improvement Study (OASIS)
Volume 5 North Atlantic, Central East Pacific, and
Caribbean regions communication systems description
[FAA-EM-81-17-VOL-5] p 201 N83-16318

CARTESIAN COORDINATES

User's manual for master Modeling of aerodynamic
surfaces by 3-dimensional explicit representation — input
to three dimensional computational fluid dynamics
[NASA-CR-166056] p 236 N83-18304

[NASA-TP-1972] p 221 N83-17560

CASCADE FLOW

The aerodynamic performance of several flow control
devices for internal flow systems p 221 N83-17560

CATHODE RAY TUBES

Calligraphic/raster color display for simulation
p 231 A83-22832

CEILINGS (METEOROLOGY)

Aircraft accident report. Sun West Airlines Flight 104,
Piper PA-31-350(T-1020), N41070, Durango-LaPlata
County Airport, Durango, Colorado, December 31, 1981
[PB82-910413] p 197 N83-16309

CENTRAL PROCESSING UNITS

Performance analysis of a dwell-time processor for
monopulse beacon radars p 200 A83-22726

CERAMIC COATINGS

Sputtered ceramic coatings and sealing layers
[DE82-005225] p 226 N83-16531

CERMETS

Coating with overlay metallic-cermet alloy systems
[NASA-CASE-LEW-13639-2] p 227 N83-17683

CHARPY IMPACT TEST

Materials screening tests of the FOD impact design
technology program, task 4C — fan and compressor blades
for aircraft engines p 225 N83-16401

[AD-A119839] p 225 N83-16401

CHEMICAL CLEANING

Cleaning gas turbine compressors - Some service
experience with a wet-wash system p 210 A83-21350

CHEMICAL REACTIONS

Coal gasification for stationary gas-turbine applications
[DE82-902135] p 226 N83-16553

CITIES

Airport community soundproofing and relocation study
[PB82-259144] p 220 N83-16358

CIVIL AVIATION

Fixed wing and rotary wing flight testing of Navstar GPS
as a civilian navigation system p 199 A83-19777

Management of bird problem in Indian airlines
p 196 A83-21877

Fiber optic wavelength multiplexing for civil aviation
applications p 208 A83-22492

Symposium on Commercial Aviation Energy
Conservation Strategies Papers and presentations
[AD-A107106] p 188 N83-17455

The use of helicopters in Europe: Analysis and
prospects [MBB-UD-359/82-O] p 207 N83-17533

CLEARANCES

The JT8D and JT9D engine component improvement.
Performance improvement program p 214 N83-17543

[NASA-CR-167965] p 214 N83-17543

COAL GASIFICATION

Coal gasification for stationary gas-turbine applications
[DE82-902135] p 226 N83-16553

COAXIAL FLOW

Conventional profile coaxial jet noise prediction
p 237 A83-22128

Effects of flight on noise radiated from convected ring
sources in coaxial dual flow. Part 2 The noise from
heated jets p 238 N83-17237

[NASA-CR-169736] p 238 N83-17237

Effects of noise radiated from convected ring sources
in coaxial dual flow Part 1 The noise from unheated
jets p 238 N83-17238

[NASA-CR-169737] p 238 N83-17238

COAXIAL NOZZLES

Effect of excitation on coaxial jet noise
p 237 A83-19811

COBALT ALLOYS

Effects of cobalt in nickel-base superalloys
p 223 A83-21467

COCKPITS

The automated cockpit p 208 A83-20849

Cockpit temperatures and cooling requirements of a
packed aircraft p 205 N83-16327

[ARL-MECH-ENG-NOTE-388] p 205 N83-16327

Evaluation of helicopter pilot's attitude control using a
simulated head-up display in a simulated helicopter
cockpit p 219 N83-16355

[AD-A119570] p 219 N83-16355

- Cockpit weather radar display demonstrator and ground-to-air sfences telemetry system
[NASA-CR-169830] p 210 N83-17534
- Evaluation of supplemental lights for caution bars
[FAA-CT-82-119] p 220 N83-17559
- ATR 42 will have ultramodern, innovative cockpit, avionics p 208 N83-17759
- COHERENT ACOUSTIC RADIATION**
- High bypass ratio engine noise component separation by coherence technique p 211 A83-22159
- COLLISION AVOIDANCE**
- Conflict monitoring analysis of parallel opposite direction routes, volume 2
[AD-A120187] p 202 N83-16323
- COLOR**
- Development of the precision approach path indicator light unit
[RAE-TM-FS(B)-483] p 202 N83-17527
- COLOR VISION**
- Calligraphic/raster color display for simulation p 231 A83-22832
- COMBUSTION CHAMBERS**
- Improved fault detection in the hot section of turbojet engines by individual monitoring procedures p 210 A83-19666
- Effect of broad properties fuel on injector performance in a reverse flow combustor
[AIAA PAPER 83-0154] p 210 A83-21079
- Errors in the experimental determination of the parameters of supersonic combustion ramjet engines p 211 A83-22653
- Gas turbine combustor modelling for calculating pollutant emission p 212 A83-23142
- COMBUSTION PHYSICS**
- Investigation of slurry fuel performance for use in a ramjet propulsor p 223 A83-21014
- COMBUSTION PRODUCTS**
- Sooting tendency of fuels containing polycyclic aromatics in a research combustor p 225 A83-23138
- Air traffic control its effect on fuel conservation p 202 N83-17464
- COMMAND AND CONTROL**
- United States Air Force tactical reconnaissance - An analysis and commentary p 186 A83-22574
- Distributed micro-processor applications to guidance and control systems
[AGARD-AR-178] p 236 N83-18295
- Microprocessor applications to guidance and control architectures p 236 N83-18297
- COMMAND GUIDANCE**
- Distributed micro-processor applications to guidance and control systems
[AGARD-AR-178] p 236 N83-18295
- COMMERCIAL AIRCRAFT**
- Demonstration of reparability and repair quality on graphite/epoxy structural subelements p 186 A83-20485
- Operator influences on aircraft design p 204 A83-21032
- Will technology make the helicopter competitive p 204 A83-21574
- Advances in high-speed rolling-element bearings --- for aircraft engine and transmission application p 231 A83-22319
- Repair techniques for graphite/epoxy structures for commercial transport applications
[NASA-CR-159056] p 225 N83-16397
- Symposium on Commercial Aviation Energy Conservation Strategies Papers and presentations
[AD-A107106] p 188 N83-17455
- Evaluation of laminar flow control systems for subsonic commercial transport aircraft. Executive summary
[NASA-CR-159252] p 216 N83-17551
- Minimum-fuel turning climbout and descent guidance of transport jets
[NASA-TM-84289] p 217 N83-17552
- COMMUNICATION NETWORKS**
- The development of standards for the common ICAO Data Interchange Network /CIDIN/ p 230 A83-22027
- Oceanic Area System Improvement Study (OASIS) Volume 5. North Atlantic, Central East Pacific, and Caribbean regions communication systems description
[FAA-EM-81-17-VOL-5] p 201 N83-16318
- COMPATIBILITY**
- Airport noise Land-use compatibility by the year 2000
[PB82-259151] p 220 N83-16359
- COMPOSITE MATERIALS**
- The development of advanced composite front fuselage technology p 202 A83-20464
- Advanced composite materials in aerobatic aircraft p 203 A83-20496
- Design, analyses, and model tests of an aerostatically tailored lifting surface p 204 A83-22155
- Advanced composite elevator for Boeing 727 aircraft, volume 2
[NASA-CR-159258] p 205 N83-16330

- Material characterization Part B Mechanical properties of 2 metal matrix composite materials
[AD-A119829] p 225 N83-16402
- Composite structural materials
[NASA-CR-169859] p 226 N83-17597
- The electrical properties of carbon fibre composites p 227 N83-17618
- COMPOSITE STRUCTURES**
- Damage tolerance and reparability of advanced composite structures p 222 A83-20484
- Elevated temperature repairs of advanced composite structures p 223 A83-20499
- Design considerations for the construction of a Shenfi wing in composite materials
[BU-280] p 206 N83-16337
- Program for establishing long-time flight service performance of composite materials in the center wing structure of C-130 aircraft. Phase 5 Flight service and inspection
[NASA-CR-165770] p 227 N83-17600
- Manufacturing processes for aeronautical structures p 227 N83-17620
- Specific examples of aerospace applications of composites p 227 N83-17621
- COMPRESSED AIR**
- Evaluation of lubricants for air compressors
[PB82-259003] p 226 N83-16538
- COMPRESSOR BLADES**
- Blade erosion effects on aircraft-engine compressor performance
[DE82-021791] p 213 N83-16346
- Materials screening tests of the FOD impact design technology program, task 4C --- fan and compressor blades for aircraft engines
[AD-A119839] p 225 N83-16401
- Turbine engine fuel conservation by fan and compressor profile control p 213 N83-17467
- Erosion of protective compressor coatings
[NLR-MP-87067-U] p 228 N83-17716
- COMPRESSORS**
- Compressor cascade performance deterioration caused by sand ingestion
[NASA-CR-168067] p 190 N83-16286
- Evaluation of lubricants for air compressors
[PB82-259003] p 226 N83-16538
- Development of a procedure for calculating the effects of airfoil erosion on aircraft engine compressor performance p 213 N83-17457
- Summary report for CF6 jet engine diagnostics program
[NASA-CR-165582] p 214 N83-17539
- COMPUTATIONAL FLUID DYNAMICS**
- Optimization of the supersonic drag of a smooth wing by use of linearized potential theory --- French thesis p 188 A83-20400
- Numerical calculations for performances of propellers in a static-state by vortex theory accounting of slipstream deformation and their comparisons with experiments p 189 A83-22072
- Fuselage-lifting surfaces interaction in unsteady subsonic flow --- French thesis p 189 A83-22093
- Unsteady transonic flow over wings including inviscid/viscous interaction p 190 A83-22132
- Analysis of aero-optic interface phenomena p 190 A83-22588
- A transonic quasi-3D analysis for gas turbine engines including split-flow capability for turbofans p 190 A83-22647
- Numerical calculation of the separation and connection of two-dimensional supersonic flows in channels with discontinuous boundaries p 212 A83-22658
- The role of analysis in the aerodynamic design of advanced rotors p 192 N83-17471
- Representation of airfoil behaviour p 192 N83-17472
- Studies of aerofoils and blade tips for helicopters p 193 N83-17473
- Calculation of 3D unsteady transonic flow around rotor blades p 193 N83-17474
- Prediction and experimental verification of the velocity fields of a rotor during hovering p 193 N83-17477
- Studies on blade-to-blade and rotor-fuselage-tail interferences p 193 N83-17479
- Methods used at Aerospatiale for calculating the loads on a rotor and experimental cross checks p 194 N83-17486
- User's manual for master Modeling of aerodynamic surfaces by 3-dimensional explicit representation --- input to three dimensional computational fluid dynamics
[NASA-CR-166056] p 236 N83-18304
- COMPUTER AIDED DESIGN**
- Curvature transitions of composite curves and surfaces - Questions regarding details of computer-aided design --- German thesis p 235 A83-20398
- Studies of aerofoils and blade tips for helicopters p 193 N83-17473

- User's manual for master Modeling of aerodynamic surfaces by 3-dimensional explicit representation --- input to three dimensional computational fluid dynamics
[NASA-CR-166056] p 236 N83-18304
- COMPUTER AIDED MANUFACTURING**
- USAF's design guide coming out next month p 239 A83-20647
- Automated machining of turbine blades by Rolls-Royce p 229 A83-21348
- COMPUTER DESIGN**
- The software-implemented fault tolerance /SIFT/ approach to fault tolerant computing p 235 A83-22825
- Naval Airship Program for Sizing and Performance (NAPSAP), computer program development Program update number 2
[AD-A120830] p 191 N83-16293
- COMPUTER GRAPHICS**
- Calligraphic/raster color display for simulation p 231 A83-22832
- Computer-generated images in visual simulation and avionic technologies p 219 A83-22835
- Pilot task profiles, human factors, and image realism p 219 A83-22836
- A study of real-time computer graphic display technology for aeronautical applications
[NASA-CR-169828] p 236 N83-18307
- COMPUTER PROGRAMS**
- Three computer based aids to maintenance scheduling
[AD-A120351] p 187 N83-16280
- Naval Airship Program for Sizing and Performance (NAPSAP), computer program development. Program update number 2
[AD-A120830] p 191 N83-16293
- Program to compute the positions of the aircraft and of the aircraft sensor footprints
[E83-10139] p 234 N83-16814
- Computerized engine and airplane performance monitoring programs p 188 N83-17465
- A practical economic criterion for fuel conservation p 239 N83-17468
- Aeroelastic equilibrium of an helicopter rotor with nonlinear aerodynamic forces p 235 N83-17482
- First results for the definition of a general rotorcraft dynamic program p 236 N83-17483
- DATAMAP and its impact on prediction programs p 236 N83-17489
- The A-7E software requirements document Three years of change data
[AD-A121602] p 237 N83-18322
- COMPUTER SYSTEMS DESIGN**
- The on-board computer system for the F29 prototype flight test
[NLR-MP-81034-U] p 209 N83-16339
- A study of real-time computer graphic display technology for aeronautical applications
[NASA-CR-169828] p 236 N83-18307
- COMPUTERIZED SIMULATION**
- CTOL, STOAL, V/STOL - An operational companion for forward deployed CVNs p 196 A83-22157
- Real-time multiradar simulation with a multiprocessor p 200 A83-22824
- Realistic 'feel' in flight simulators is based on precise control loading p 219 A83-23240
- In-flight investigation of large airplane flying qualities for approach and landing p 206 N83-16332
- Flight simulation test of National Aerospace Laboratory STOL-research-aircraft. Part 1 STOL configuration
[NAL-TR-713-PT-1] p 207 N83-17528
- Aids to decision making in airport planning
[REPT-34] p 221 N83-17562
- CONCORDE AIRCRAFT**
- Flying and design of aircraft
[RAE-TRANS-2070] p 205 N83-16326
- CONFERENCES**
- Israel Annual Conference on Aviation and Astronautics, 24th, Tel Aviv and Haifa, Israel, February 17, 18, 1982, Collection of Papers p 186 A83-21001
- Israel Conference on Mechanical Engineering, 16th, Technion - Israel Institute of Technology, Haifa, Israel, July 13, 14, 1982, Proceedings p 231 A83-22318
- Symposium on Commercial Aviation Energy Conservation Strategies Papers and presentations
[AD-A107106] p 188 N83-17455
- Prediction of Aerodynamic Loads on Rotorcraft --- helicopter and wind turbine rotors
[AGARD-CP-334] p 188 N83-17470
- Practical Considerations of Design, Fabrication and Tests for Composite Materials
[AGARD-LS-124] p 227 N83-17609

CONSTRAINTS

Vertical impact tests of a modified F/B-111 crew seat to evaluate headrest position and restraint configuration effects
[AD-A120255] p 197 N83-16311

CONTROL

Turbine engine fuel conservation by fan and compressor profile control p 213 N83-17467
Effect of external stores on the stability and control characteristics of a delta wing fighter model at Mach numbers from 0.60 to 2.01
[NASA-TM-84596] p 194 N83-17508

CONTROL CONFIGURED VEHICLES

F-104 CCV research flight test program p 215 A83-20074

CONTROL SIMULATION

Identification of certain dynamic characteristics of a helicopter-autopilot system by means of simulation p 216 A83-23222

CONTROL SURFACES

Realistic 'feel' in flight simulators is based on precise control loading p 219 A83-23240
Eigenspace techniques for active flutter suppression
[NASA-CR-169858] p 217 N83-17556

CONTROL THEORY

Extended perfect model following --- control system synthesis technique p 235 A83-20289
Constrained eigenvalue/eigenvector assignment - Application to flight control systems p 215 A83-21006
Performance measures for aircraft carrier landings as a function of aircraft dynamics
[AD-A120473] p 206 N83-16334

CONTROLLABILITY

A control model for maneuvering flight for application to a computer flight testing program
[NLR-MP-81046-U] p 207 N83-17531
Criteria for handling qualities of military aircraft
[AGARD-AR-186] p 217 N83-17555

CONTROLLERS

Benefits assessment of active control technology and related cockpit technology for rotorcraft
[NASA-CR-166406] p 217 N83-17553

CONVERGENT-DIVERGENT NOZZLES

Internal performance prediction for advanced exhaust systems --- for tactical aircraft p 211 A83-22156

COOLANTS

Aerodynamic effect of a honeycomb rotor tip shroud on a 50.8-centimeter-tip-diameter core turbine
[NASA-TP-2112] p 215 N83-17547

COOLING

Cockpit temperatures and cooling requirements of a packed aircraft
[ARL-MECH-ENG-NOTE-388] p 205 N83-16327
The JT8D and JT9D engine component improvement Performance improvement program
[NASA-CR-167965] p 214 N83-17543

CORNER FLOW

Aerosound from corner flow and flap flow
[AIAA PAPER 81-2039] p 237 A83-19813

CORROSION RESISTANCE

The corrosion resistance of protective coatings p 223 A83-21454
Erosion of protective compressor coatings
[NLR-MP-87067-U] p 228 N83-17716

COST ANALYSIS

The Fokker F28 and a four-engined newcomer p 204 A83-21349
Oceanic Area System Improvement Study (OASIS) Volume 7 North Atlantic region flight cost model results
[FAA-EM-81-17-VOL-7] p 201 N83-16319
Oceanic Area System Improvement Study (OASIS) Volume 8 Central East Pacific region flight cost model results
[FAA-EM-81-17-VOL-8] p 201 N83-16320
Oceanic Area System Improvement Study (OASIS) Volume 9 Flight cost model description
[FAA-EM-81-17-VOL-9] p 201 N83-16321

COST REDUCTION

USAF's design guide coming out next month p 239 A83-20647
Will technology make the helicopter competitive p 204 A83-21574

COWLINGS

A study of optimum cowl shapes and flow port locations for minimum drag with effective engine cooling, volume 1
[NASA-CR-159379] p 191 N83-16288
A study of optimum cowl shapes and flow port locations for minimum drag with effective engine cooling, volume 2
[NASA-CR-159380] p 191 N83-16289

CRACK GEOMETRY

Analysis and repair of flaws in thick structures p 230 A83-21654

CRACK INITIATION

Equivalent damage A critical assessment
[NASA-CR-167874] p 214 N83-17542

CRACK PROPAGATION

Practical application of a model for fatigue damage with irregular cyclic loading p 224 A83-21757
An improved methodology for predicting random spectrum load interaction effects on fatigue crack growth p 224 A83-21802

CRACKING (FRACTURING)

Practical application of fracture mechanics p 230 A83-21799
Creep and fatigue interactions in a nickel base superalloy
[NLR-MP-82003-U] p 234 N83-17903

CRACKS

Fatigue threshold and short crack significance for aircraft
[NLR-MP-82007-U] p 234 N83-17902

CRASH LANDING

Studies on an acceleration platform and at the time of a simulated crash of helicopter antirash seats p 197 A83-22976

CRASHWORTHINESS

Human Factors Aspects of Aircraft Accidents
[AGARD-LS-125] p 188 N83-17490
The influence of handling qualities, crashworthiness and other engineering factors on aircraft safety p 198 N83-17493

CREEP RUPTURE STRENGTH

Creep and fatigue interactions in a nickel base superalloy
[NLR-MP-82003-U] p 234 N83-17903

CREEP STRENGTH

Fatigue and creep considerations in the design of turbine components p 230 A83-21461
The interaction of high temperature corrosion and mechanical properties of alloys p 224 A83-21470

CRITICAL VELOCITY

Nonlinear forced oscillations of a rotating shaft carrying an unsymmetrical rotor at the major critical speed p 228 A83-20288

CRUISING FLIGHT

Fuel conservation techniques in jet transport aircraft operations p 198 N83-17463
Minimum-fuel turning climbout and descent guidance of transport jets
[NASA-TM-84289] p 217 N83-17552

CRYSTAL DISLOCATIONS

Creep and fatigue interactions in a nickel base superalloy
[NLR-MP-82003-U] p 234 N83-17903

CURING

Manufacturing processes for aeronautical structures p 227 N83-17620

CURVATURE

Curvature transitions of composite curves and surfaces - Questions regarding details of computer-aided design --- German thesis p 235 A83-20398

CURVES (GEOMETRY)

User's manual for master Modeling of aerodynamic surfaces by 3-dimensional explicit representation --- input to three dimensional computational fluid dynamics
[NASA-CR-166056] p 236 N83-18304

CYCLIC LOADS

Practical application of a model for fatigue damage with irregular cyclic loading p 224 A83-21757
Creep and fatigue interactions in a nickel base superalloy
[NLR-MP-82003-U] p 234 N83-17903

CYLINDRICAL SHELLS

Theoretical and experimental evaluation of transmission loss of cylinders --- as idealized aircraft fuselages p 237 A83-19808

D**DAMAGE**

Fatigue threshold and short crack significance for aircraft
[NLR-MP-82007-U] p 234 N83-17902

DAMAGE ASSESSMENT

Improved fault detection in the hot section of turbojet engines by individual monitoring procedures p 210 A83-19666
Analysis of target coverage for an unstabilized 35 mm panoramic strike camera p 231 A83-22596
Equivalent damage A critical assessment
[NASA-CR-167874] p 214 N83-17542

DAMPING

Analytical and experimental investigation of turbine blade damping
[AD-A120470] p 213 N83-16345

DATA ACQUISITION

Thermal infrared pushbroom imagery acquisition and processing --- of NASA's Advanced Land Observing System p 209 A83-22841
Mode S baseline radar tracking
[FAA-RD-82-53] p 233 N83-17770

DATA BASES

Spatial calibration of a multispectral data base --- of airborne scanner systems p 209 A83-22882
DATAMAP and its impact on prediction programs p 236 N83-17489

DATA MANAGEMENT

DATAMAP and its impact on prediction programs p 236 N83-17489

DATA PROCESSING

Computer based maintenance aids system Preliminary development and evaluation of a prototype
[AD-A120627] p 187 N83-16281
The F29 flight test instrumentation and data processing system An overview of requirements, design and organization
[NLR-MP-81035-U] p 209 N83-16340
DATAMAP and its impact on prediction programs p 236 N83-17489

DATA TRANSMISSION

The development of standards for the common ICAO Data Interchange Network /CIDIN/ p 230 A83-22027
Fiber optics for electro-magnetic pulse /EMP/ simulators p 218 A83-22495

DECISION MAKING

Aids to decision making in airport planning
[REPT-34] p 221 N83-17562

DEFECTS

Repair techniques for graphite/epoxy structures for commercial transport applications
[NASA-CR-159056] p 225 N83-16397

DEGRADATION

Analysis of a MIL-L-27502 lubricant from a gas-turbine engine test by size-exclusion chromatography
[NASA-TP-2063] p 226 N83-16528

DELTA WINGS

Theoretical stiffness matrix correction by using static test results p 229 A83-21007
Subsonic steady and unsteady aerodynamic loads on missiles and aircraft
[NASA-CR-169749] p 190 N83-16284
Laser-Doppler velocimeter (LDV) measurements of the velocity field of a leading edge vortex over a delta wing before and after vortex breakdown
[VKI-TN-142] p 192 N83-16300
Effect of external stores on the stability and control characteristics of a delta wing fighter model at Mach numbers from 0.60 to 2.01
[NASA-TM-84596] p 194 N83-17508
The minimization of pylon-mounted store effects on air combat capability
[NASA-TM-84597] p 195 N83-17510

DESCENT TRAJECTORIES

Planning fuel-conservative descents with or without time constraints using a small programmable calculator Algorithm development and flight test results
[NASA-TP-2085] p 210 N83-17535
Minimum-fuel turning climbout and descent guidance of transport jets
[NASA-TM-84289] p 217 N83-17552

DESIGN ANALYSIS

A wind tunnel for unsteady turbulent shear flows - Design and flow calculation p 218 A83-19664
Unbalance response analysis of a complete turbomachine p 228 A83-19674
Curvature transitions of composite curves and surfaces - Questions regarding details of computer-aided design --- German thesis p 235 A83-20398
The future for fighter aircraft p 186 A83-20597
Technology and modern fighter aircraft - The evolutionary F-16 p 203 A83-20598
NGT - The Next Generation Trainer p 203 A83-20599

Setting design goals for advanced propulsion systems
[AIAA PAPER 81-1505] p 211 A83-22154
Errors in the experimental determination of the parameters of supersonic combustion ramjet engines p 211 A83-22653

Naval Airship Program for Sizing and Performance (NAPSAP), computer program development Program update number 2
[AD-A120830] p 191 N83-16293
Predesign study for a modern 4-bladed rotor for the RSRA
[NASA-CR-166155] p 206 N83-16331
Composite design of an advanced airborne monitoring system
[DE82-006980] p 235 N83-18106

DESIGN TO COST

USAF's design guide coming out next month p 239 A83-20647

DESULFURIZING

Coal gasification for stationary gas-turbine applications
[DE82-902135] p 226 N83-16553

DETECTION

Advanced Ultra-Violet (UV) aircraft fire detection system
Volume 1. System description and flight test
[AD-A121253] p 198 N83-17526

DETERIORATION

Summary report for CF6 jet engine diagnostics
program
[NASA-CR-165582] p 214 N83-17539

DHC 4 AIRCRAFT

Spatial calibration of a multispectral data base — of
airborne scanner systems p 209 N83-22882

DIESEL FUELS

Experimental study of the thermal stability of
hydrocarbon fuels
[NASA-CR-168027] p 228 N83-17728

DIFFUSION FLAMES

Effects of envelope flames on drop gasification rates
in turbulent diffusion flames p 222 N83-19846

DIGITAL NAVIGATION

CINNA - A system for preparing reconnaissance
missions p 200 N83-22591

DIGITAL TECHNIQUES

Flight simulation test of National Aerospace Laboratory
STOL-research-aircraft. Part 1 STOL configuration
[NAL-TR-713-PT-1] p 207 N83-17528

DIRECTIONAL STABILITY

The application of parameter estimation to flight
measurements to obtain lateral-directional stability
derivatives of an augmented jet-flap STOL airplane
[NASA-TP-2033] p 216 N83-16350

DISCRETE ADDRESS BEACON SYSTEM

Performance analysis of a dwell-time processor for
monopulse beacon radars p 200 N83-22726

DISPLAY DEVICES

The automated cockpit p 208 N83-20849
Calligraphic/raster color display for simulation
[NASA-CR-169830] p 231 N83-22832

Two years of training with the first true three-dimensional
simulator p 218 N83-22833
Computer-generated images in visual simulation and
avionic technologies p 219 N83-22835

Pilot task profiles, human factors, and image realism
p 219 N83-22836

Cockpit weather radar display demonstrator and
ground-to-air stencils telemetry system
[NASA-CR-169830] p 210 N83-17534

Benefits assessment of active control technology and
related cockpit technology for rotorcraft
[NASA-CR-166406] p 217 N83-17553

Composite design of an advanced airborne monitoring
system
[DE82-006980] p 235 N83-18106

Computers in avionics systems
[NLR-MP-81063-U] p 236 N83-18291

DISTRIBUTION MOMENTS

Comparison of rotor analysis results with aerodynamic
windtunnel data p 194 N83-17487

DOCUMENTATION

The A-7E software requirements document. Three years
of change data
[AD-A121602] p 237 N83-18322

DOMES (STRUCTURAL FORMS)

Target TV projector with dynamic raster shaping for use
in dome simulators p 231 N83-22834

DOORS

Serviceability evaluation of advanced composite F-14A
main-landing-gear-strut doors and overwing fairings
p 185 N83-20480

DOPPLER EFFECT

A demonstration of relative positioning using
conventional GPS Doppler receivers p 199 N83-19779

DOPPLER NAVIGATION

Radio navigation and airplane navigation
[AD-A120595] p 202 N83-16325

DOWNWASH

Obscuration by helicopter-produced snow clouds
p 197 N83-22357

DRAG

Development of aerodynamic prediction methods for
irregular planform wings
[NASA-CR-3664] p 195 N83-17515

DRAG REDUCTION

A study of optimum cowl shapes and flow port locations
for minimum drag with effective engine cooling, volume
1
[NASA-CR-159379] p 191 N83-16288

A study of optimum cowl shapes and flow port locations
for minimum drag with effective engine cooling, volume
2
[NASA-CR-159380] p 191 N83-16289

DUCTS

The aerodynamic performance of several flow control
devices for internal flow systems
[NASA-TP-1972] p 221 N83-17560

DYNAMIC CHARACTERISTICS

Identification of certain dynamic characteristics of a
helicopter-autopilot system by means of simulation
p 216 N83-23222

DYNAMIC LOADS

Methods used at Aerospatiale for calculating the loads
on a rotor and experimental cross checks
p 194 N83-17486

DYNAMIC MODELS

A simulation model for the analysis of the dynamic
behavior of a helicopter rotor under nonstationary limit flight
conditions p 204 N83-23220

First results for the definition of a general rotorcraft
dynamic program p 236 N83-17483

A control model for maneuvering flight for application
to a computer flight testing program
[NLR-MP-81046-U] p 207 N83-17531

DYNAMIC RESPONSE

Unbalance response analysis of a complete
turbomachine p 228 N83-19674

DYNAMIC STRUCTURAL ANALYSIS

The role of analysis in the aerodynamic design of
advanced rotors p 192 N83-17471

E**ECONOMIC IMPACT**

A practical economic criterion for fuel conservation
p 239 N83-17468

EDDY CURRENTS

Eddy current impedance plane analysis
p 231 N83-22410

EFFECTIVE PERCEIVED NOISE LEVELS

USAF Environmental Noise Data Handbook Volume
150 C-140 in-flight crew noise
[AD-A120508] p 238 N83-17246

USAF Bioenvironmental Noise Data Handbook Volume
152 C-12A in-flight crew noise
[AD-A120509] p 238 N83-17247

EIGENVALUES

Eigensolutions for liners in uniform mean flow ducts
p 237 N83-19810

Constrained eigenvalue/eigenvector assignment -
Application to flight control systems p 215 N83-21006

Eigenspace techniques for active flutter suppression
[NASA-CR-169858] p 217 N83-17556

EIGENVECTORS

Constrained eigenvalue/eigenvector assignment -
Application to flight control systems p 215 N83-21006

ELASTIC BODIES

The aeroelastic behavior of curved helicopter blades
in hovering and axial flight p 203 N83-21017

ELASTIC PROPERTIES

A simplified model of the influence of elastic pitch
variations on the rotor flapping dynamics
p 204 N83-21025

ELECTRIC SPARKS

Electrical discharge machining of aluminum honeycomb
core p 229 N83-20500

ELECTRICAL IMPEDANCE

Eddy current impedance plane analysis
p 231 N83-22410

ELECTRICAL PROPERTIES

The electrical properties of carbon fibre composites
p 227 N83-17618

ELECTRO-OPTICS

Electro-optical calibration considerations at intermediate
maintenance levels p 232 N83-22883

ELECTROLUMINESCENCE

Desirable characteristics of underwater lights for
helicopter escape hatches
[AD-A120510] p 198 N83-16312

ELECTROMAGNETIC PULSES

Fiber optics for electro-magnetic pulse (EMP)/
simulators p 218 N83-22495

ELECTRONIC EQUIPMENT TESTS

Electro-optical calibration considerations at intermediate
maintenance levels p 232 N83-22883

ELEVATORS (CONTROL SURFACES)

Advanced composite elevator for Boeing 727 aircraft,
volume 2
[NASA-CR-159258] p 205 N83-16330

EMBEDDING

Embedded flow characteristics of sharp-edged
rectangular wings p 190 N83-22152

ENERGY CONSERVATION

Symposium on Commercial Aviation Energy
Conservation Strategies. Papers and
presentations
[AD-A107106] p 188 N83-17455

Potential fuel savings through
maintenance p 188 N83-17456

Aircraft towing feasibility study p 207 N83-17458

The analysis of integrated fuel efficient, low noise
procedures in lax terminal area operations --- (Los
Angeles) p 202 N83-17459

An overview of the DOT/FAA aviation energy
conservation policy p 235 N83-17460

Air traffic control Its effect on fuel conservation
p 202 N83-17464

Computerized engine and airplane performance
monitoring programs p 188 N83-17465

Slidestip indication system p 210 N83-17466

Turbine engine fuel conservation by fan and compressor
profile control p 213 N83-17467

A practical economic criterion for fuel conservation
p 239 N83-17468

ENGINE CONTROL

Design of an integrated control system for a supersonic
aircraft power plant p 212 N83-23175

ENGINE DESIGN

Finite element strength analysis of rotating shell-plate
structures p 229 N83-21448

Setting design goals for advanced propulsion systems
[AIAA PAPER 81-1505] p 211 N83-22154

Theory and design of flight-vehicle engines — Russian
book p 211 N83-22651

Errors in the experimental determination of the
parameters of supersonic combustion ramjet engines
p 211 N83-22653

Features of the selection of the basic parameters of
cooled GTE turbines p 211 N83-22655

On the choice of the optimal total wedge angle for the
air intake of a hypersonic ramjet engine p 212 N83-22656

The ideas of F. A. Tsander and an assessment of the
application of jet engines for the acceleration of aerospace
vehicles p 221 N83-22657

Design of an integrated control system for a supersonic
aircraft power plant p 212 N83-23175

PW 4000 - A radically new jet engine being developed
in the USA p 212 N83-23239

Energy efficient engine Fan test hardware detailed
design report
[NASA-CR-165148] p 212 N83-16341

The CF6 engine performance improvement
[NASA-CR-165612] p 212 N83-16342

Study of advanced rotary combustion engines for
commuter aircraft
[NASA-CR-165399] p 214 N83-17545

ENGINE INLETS

Fiber optics for aircraft engine/inlet control
p 211 N83-22494

A study of optimum cowl shapes and flow port locations
for minimum drag with effective engine cooling, volume
1
[NASA-CR-159379] p 191 N83-16288

A study of optimum cowl shapes and flow port locations
for minimum drag with effective engine cooling, volume
2
[NASA-CR-159380] p 191 N83-16289

ENGINE MONITORING INSTRUMENTS

Improved fault detection in the hot section of turbojet
engines by individual monitoring procedures
p 210 N83-19666

ENGINE NOISE

Eigensolutions for liners in uniform mean flow ducts
p 237 N83-19810

Effect of excitation on coaxial jet noise
p 237 N83-19811

High bypass ratio engine noise component separation
by coherence technique p 211 N83-22159

Effects of light on noise radiated from convected ring
sources in coaxial dual flow Part 2 The noise from
heated jets
[NASA-CR-169736] p 238 N83-17237

Effects of noise radiated from convected ring sources
in coaxial dual flow Part 1 The noise from unheated
jets
[NASA-CR-169737] p 238 N83-17238

ENGINE PARTS

Fabrication technology for aircraft engines — Russian
book p 185 N83-20381

Fatigue and creep considerations in the design of turbine
components p 230 N83-21461

Fatigue failure under fretting conditions
p 224 N83-21481

Rotor-fuselage interference on engine internal
aerodynamics in maneuvering high-speed rotorcraft
p 193 N83-17480

The JT9D Jet Engine Diagnostics Program
[NASA-CR-167966] p 214 N83-17544

Flight evaluation of an engine static pressure noseprobe
in an F-15 airplane
[NASA-CR-163109] p 214 N83-17546

ENGINE TESTS

Compact installation for testing vectored-thrust
engines p 218 N83-22158

- Theory and design of flight-vehicle engines — Russian book p 211 A83-22651
- Current problems in the testing of aircraft engines p 211 A83-22652
- A limited study of thrust vector control with guide vanes and jet rudder [FOA-C-20455-E3] p 221 N83-16386
- Flight evaluation of an engine static pressure noseprobe in an F-15 airplane [NASA-CR-163109] p 214 N83-17546
- ENGINES**
- Rotor-fuselage interference on engine internal aerodynamics in maneuvering high-speed rotorcraft p 193 N83-17480
- ENVIRONMENT SIMULATION**
- Computer-generated images in visual simulation and avionic technologies p 219 A83-22835
- ENVIRONMENT SIMULATORS**
- Fiber optics for electro-magnetic pulse /EMP/ simulators p 218 A83-22495
- ENVIRONMENTAL TESTS**
- The interaction of high temperature corrosion and mechanical properties of alloys p 224 A83-21470
- EPOXY RESINS**
- Plastic tooling for advanced composites p 222 A83-20481
- Aging and performance of structural film adhesives I - A comparison of two high-temperature curing, epoxy-based systems p 223 A83-21048
- EQUATIONS OF MOTION**
- General basic concepts for a trajectory simulation of a guided missile [PML-1981-36] p 221 N83-17574
- EROSION**
- Compressor cascade performance deterioration caused by sand ingestion [NASA-CR-168067] p 190 N83-16286
- Blade erosion effects on aircraft-engine compressor performance [DE82-021791] p 213 N83-16346
- Erosion of protective compressor coatings [NLR-MP-87067-U] p 228 N83-17716
- EROSIVE BURNING**
- Development of a procedure for calculating the effects of airfoil erosion on aircraft engine compressor performance p 213 N83-17457
- ERROR ANALYSIS**
- Errors in the experimental determination of the parameters of supersonic combustion ramjet engines p 211 A83-22653
- ESCAPE SYSTEMS**
- Desirable characteristics of underwater lights for helicopter escape hatches [AD-A120331] p 197 N83-16310
- Desirable characteristics of underwater lights for helicopter escape hatches [AD-A120510] p 198 N83-16312
- ESTERS**
- Analysis of a MIL-L-27502 lubricant from a gas-turbine engine test by size-exclusion chromatography [NASA-TP-2063] p 226 N83-16528
- EUROPEAN AIRBUS**
- The half-model technique in the wind tunnel and its employment in the development of the airbus family [NASA-TM-76970] p 205 N83-16328
- EXHAUST EMISSION**
- Gas turbine combustor modelling for calculating pollutant emission p 212 A83-23142
- EXHAUST GASES**
- Water injection into compressors of gas turbines for power increase and reduction of NOX emission [BMFT-FB-T-82-075] p 233 N83-16765
- Air traffic control Its effect on fuel conservation p 202 N83-17464
- An investigation of the effectiveness of smoke suppressant fuel additives for turbojet applications [AD-A121228] p 215 N83-17549
- EXHAUST NOZZLES**
- Internal performance prediction for advanced exhaust systems — for tactical aircraft p 211 A83-22156
- EXTERNAL STORES**
- Effect of external stores on the stability and control characteristics of a delta wing fighter model at Mach numbers from 0.60 to 2.01 [NASA-TM-84596] p 194 N83-17508

F

- F-104 AIRCRAFT**
- F-104 CCV research flight test program p 215 A83-20074
- F-111 AIRCRAFT**
- Advanced Ultra-Violet (UV) aircraft fire detection system Volume 1. System description and flight test [AD-A121253] p 198 N83-17526

- F-14 AIRCRAFT**
- Serviceability evaluation of advanced composite F-14A main-landing-gear-strut doors and overwing fairings p 185 A83-20480
- F-15 AIRCRAFT**
- Flight evaluation of an engine static pressure noseprobe in an F-15 airplane [NASA-CR-163109] p 214 N83-17546
- F-16 AIRCRAFT**
- Technology and modern fighter aircraft - The evolutionary F-16 p 203 A83-20598
- F-16 pulse Doppler radar /AN/APG-66/ performance p 200 A83-22737
- F-28 TRANSPORT AIRCRAFT**
- The Fokker F28 and a four-engined newcomer p 204 A83-21349
- F-4 AIRCRAFT**
- Application of vector performance optimization to a robust control loop design for a fighter aircraft p 215 A83-21160
- FABRICATION**
- Fabrication technology for aircraft engines — Russian book p 185 A83-20381
- FAIL-SAFE SYSTEMS**
- Fatigue threshold and short crack significance for aircraft [NLR-MP-82007-U] p 234 N83-17902
- FAIRINGS**
- Serviceability evaluation of advanced composite F-14A main-landing-gear-strut doors and overwing fairings p 185 A83-20480
- FAN BLADES**
- Energy efficient engine Fan test hardware detailed design report [NASA-CR-165148] p 212 N83-16341
- Materials screening tests of the FOD impact design technology program, task 4C — fan and compressor blades for aircraft engines [AD-A119839] p 225 N83-16401
- Material characterization Part B Mechanical properties of 2 metal matrix composite materials [AD-A119829] p 225 N83-16402
- Aircraft turbofan noise [NASA-TM-83317] p 239 N83-18405
- FAN FIELDS**
- Comparison of forward flight effects theory of A Michalke and U. Michel with measured data [NASA-CR-3665] p 238 N83-17239
- Computer program to predict noise of general aviation aircraft User's guide [NASA-CR-168050] p 238 N83-17242
- Aircraft turbofan noise [NASA-TM-83317] p 239 N83-18405
- FASTENERS**
- Technical and secretariat support of the MIL-STD-1515 fastener standardization effort [AD-A119828] p 232 N83-16760
- FATIGUE (MATERIALS)**
- Fatigue threshold and short crack significance for aircraft [NLR-MP-82007-U] p 234 N83-17902
- FATIGUE LIFE**
- Fatigue and creep considerations in the design of turbine components p 230 A83-21461
- Fatigue failure under fretting conditions p 224 A83-21481
- Rolling-element fatigue life of AMS 5900 balls [NASA-TP-2080] p 232 N83-16758
- Bearing fatigue investigation 3 [NASA-CR-168029] p 233 N83-17880
- Creep and fatigue interactions in a nickel base superalloy [NLR-MP-82003-U] p 234 N83-17903
- FATIGUE TESTS**
- The simulation of fatigue loads in aeronautics p 219 A83-23241
- Rolling-element fatigue life of AMS 5900 balls [NASA-TP-2080] p 232 N83-16758
- FAULT TOLERANCE**
- The software-implemented fault tolerance /SIFT/ approach to fault tolerant computing p 235 A83-22825
- FEASIBILITY ANALYSIS**
- Pre-design study for a modern 4-bladed rotor for the RSRA [NASA-CR-166155] p 206 N83-16331
- FEEDBACK CONTROL**
- Extended perfect model following — control system synthesis technique p 235 A83-20289
- Application of vector performance optimization to a robust control loop design for a fighter aircraft p 215 A83-21160
- Design of an integrated control system for a supersonic aircraft power plant p 212 A83-2175

- FEEDFORWARD CONTROL**
- Extended perfect model following — control system synthesis technique p 235 A83-20289
- FIBER COMPOSITES**
- Practical Considerations of Design, Fabrication and Tests for Composite Materials [AGARD-LS-124] p 227 N83-17609
- The nature of fibre composite materials p 227 N83-17610
- FIBER OPTICS**
- USAF ground fiber optic development program p 228 A83-19711
- Fiber optic wavelength multiplexing for civil aviation applications p 208 A83-22492
- Fiber optics for aircraft engine/inlet control p 211 A83-22494
- Fiber optics for electro-magnetic pulse /EMP/ simulators p 218 A83-22495
- FIBER REINFORCED COMPOSITES**
- Plastic tooling for advanced composites p 222 A83-20481
- Elevated temperature repairs of advanced composite structures p 223 A83-20499
- Composite structural materials [NASA-CR-169859] p 226 N83-17597
- Practical Considerations of Design, Fabrication and Tests for Composite Materials [AGARD-LS-124] p 227 N83-17609
- FIGHTER AIRCRAFT**
- The development of advanced composite front fuselage technology p 202 A83-20464
- The future for fighter aircraft p 186 A83-20597
- Thirty years of fighter armament p 203 A83-20600
- Suboptimal filters for INS alignment on a moving base p 199 A83-21019
- Effect of external stores on the stability and control characteristics of a delta wing fighter model at Mach numbers from 0.60 to 2.01 [NASA-TM-84596] p 194 N83-17508
- The minimization of pylon-mounted store effects on air combat capability [NASA-TM-84597] p 195 N83-17510
- FINITE DIFFERENCE THEORY**
- Finite difference calculation of an inviscid transonic flow over oscillating airfoils [RAE-TRANS-2087] p 191 N83-16292
- FINITE ELEMENT METHOD**
- A superelement analysis of stiffened shells — Russian book on aircraft fuselage structures p 202 A83-20392
- Finite element strength analysis of rotating shell-plate structures p 229 A83-21448
- Analysis and repair of flaws in thick structures p 230 A83-21654
- A transonic quasi-3D analysis for gas turbine engines including split-flow capability for turbofans p 190 A83-22647
- An interactive system for transformation of known measures long internal surface of cylinders model for shafts [ISD-294] p 233 N83-17748
- FINS**
- Helicopter fin effectiveness [BU-271] p 206 N83-16336
- FIRE DAMAGE**
- Sandia Aircraft Crashfire Facility [DE82-004297] p 198 N83-16313
- FIRE EXTINGUISHERS**
- In-flight aircraft seat fire extinguishing tests (cabin hazard measurements) [FAA-CT-82-111] p 197 N83-16308
- Equivalency evaluation of firefighting agents and minimum requirements at US Air Force airfields [FAA-CT-82-109] p 198 N83-17524
- FIRE FIGHTING**
- Equivalency evaluation of firefighting agents and minimum requirements at US Air Force airfields [FAA-CT-82-109] p 198 N83-17524
- FIRES**
- Advanced Ultra-Violet (UV) aircraft fire detection system Volume 1. System description and flight test [AD-A121253] p 198 N83-17526
- FIXED WINGS**
- Fixed wing and rotary wing flight testing of Navstar GPS as a civilian navigation system p 199 A83-19777
- FLAPPING**
- A simplified model of the influence of elastic pitch variations on the rotor flapping dynamics p 204 A83-21025
- FLAPS (CONTROL SURFACES)**
- Wind tunnel force and pressure tests [NASA-CR-3439] p 190 N83-16287
- FLIGHT CHARACTERISTICS**
- F-104 CCV research flight test program p 215 A83-20074

- Prediction of the aerodynamic loads on helicopter blades in hovering and axial flight using lifting line theory p 189 A83-21016
- In-flight investigation of large airplane flying qualities for approach and landing [AD-A120202] p 206 N83-16332
- General purpose flight simulation program (FSPK-1) Part 1 Contents of the program [NAL-TR-702] p 207 N83-17529
- Criteria for handling qualities of military aircraft [AGARD-AR-186] p 217 N83-17555
- FLIGHT CONTROL**
- Investigation of the longitudinal motion of a flight vehicle by the method of the separation of motions p 215 A83-20144
- Constrained eigenvalue/eigenvector assignment - Application to flight control systems p 215 A83-21006
- An on-board near-optimal climb-dash energy management [NASA-CR-169755] p 205 N83-16329
- In-flight investigation of large airplane flying qualities for approach and landing [AD-A120202] p 206 N83-16332
- FLIGHT CREWS**
- USAF Environmental Noise Data Handbook Volume 150 C-140 in-flight crew noise [AD-A120508] p 238 N83-17246
- USAF Bioenvironmental Noise Data Handbook Volume 152 C-12A in-flight crew noise [AD-A120509] p 238 N83-17247
- FLIGHT HAZARDS**
- Remote sensing of problem birds in aviation p 196 A83-21876
- Management of bird problem in Indian airlines p 196 A83-21877
- Bird strikes to aircraft and associated hazards and problems regarding the safety of aircraft operations p 196 A83-21878
- Laser and millimeter-wave backscatter of transmission cables p 199 A83-22523
- FLIGHT PATHS**
- Automation of on-board flightpath management p 215 A83-21002
- Analysis of target coverage for an unstabilized 35 mm panoramic strike camera p 231 A83-22596
- Conflict monitoring analysis of parallel opposite direction routes, volume 2 [AD-A120187] p 202 N83-16323
- Optimal short-range trajectories for helicopters [NASA-TM-84303] p 187 N83-17451
- Minimum-fuel turning climbout and descent guidance of transport jets [NASA-TM-84289] p 217 N83-17552
- General basic concepts for a trajectory simulation of a guided missile [PML-1981-36] p 221 N83-17574
- FLIGHT PLANS**
- Flight preparation and planning p 188 N83-17462
- A practical economic criterion for fuel conservation p 239 N83-17468
- FLIGHT RECORDERS**
- The engineering investigation of aircraft accidents p 198 N83-17497
- FLIGHT SIMULATION**
- Effective aerodynamic parameter evaluation from free flight tests p 203 A83-21005
- Dynamic stability of a buoyant quad-rotor aircraft p 216 A83-22160
- Researchers study methods to combat effects of wind shear p 196 A83-22175
- Pilot task profiles, human factors, and image realism p 219 A83-22836
- A simulation model for the analysis of the dynamic behavior of a helicopter rotor under nonstationary limit flight conditions p 204 A83-23220
- The simulation of fatigue loads in aeronautics p 219 A83-23241
- Performance measures for aircraft carrier landings as a function of aircraft dynamics [AD-A120473] p 206 N83-16334
- General purpose flight simulation program (FSPK-1) Part 1 Contents of the program [NAL-TR-702] p 207 N83-17529
- A control model for maneuvering flight for application to a computer flight testing program [NLR-MP-81046-U] p 207 N83-17531
- FLIGHT SIMULATORS**
- An optimal control approach to the design of moving flight simulators p 218 A83-19949
- Realistic 'feel' in flight simulators is based on precise control loading p 219 A83-23240
- Evaluation of helicopter pilot's attitude control using a simulated head-up display in a simulated helicopter cockpit [AD-A119570] p 219 N83-16355

- Applications of simulator freeze to carrier glideslope tracking instruction [AD-A118862] p 220 N83-16356
- FLIGHT TEST INSTRUMENTS**
- The on-board computer system for the F29 prototype flight test [NLR-MP-81034-U] p 209 N83-16339
- The F29 flight test instrumentation and data processing system An overview of requirements, design and organization [NLR-MP-81035-U] p 209 N83-16340
- FLIGHT TEST VEHICLES**
- Eigenspace techniques for active flutter suppression [NASA-CR-169858] p 217 N83-17556
- FLIGHT TESTS**
- The MCA method, a flight test technique to determine the thrust of jet aircraft in flight — Mass Consumption Acceleration p 202 A83-19661
- Fixed wing and rotary wing flight testing of Navstar GPS as a civilian navigation system p 199 A83-19777
- F-104 CCV research flight test program p 215 A83-20074
- Flight test results of an active flutter suppression system p 216 A83-22164
- Dynamic structural aeroelastic stability testing of the XV-15 tilt rotor research aircraft [NASA-TM-84293] p 216 N83-16349
- The application of parameter estimation to flight measurements to obtain lateral-directional stability derivatives of an augmented jet-flap STOL airplane [NASA-TP-2033] p 216 N83-16350
- Flight evaluation of an engine static pressure noseprobe in an F-15 airplane [NASA-CR-163109] p 214 N83-17546
- Gyroscopic instruments and their application to flight testing [AGARD-AG-160-VOL-15] p 233 N83-17855
- Structural testing for static failure, flutter and other scary things [NASA-TM-84606] p 234 N83-17899
- FLIGHT TRAINING**
- Applications of simulator freeze to carrier glideslope tracking instruction [AD-A118862] p 220 N83-16356
- FLIGHT VEHICLES**
- Theory and design of flight-vehicle engines — Russian book p 211 A83-22651
- FLIR DETECTORS**
- Calibration support of the AN/AAM-60 common forward-looking infrared /FLIR/ test bench p 232 A83-22886
- Bo 105 rotor blade influence on the Calipso FLIR in the mast-mounted observation platform Ophelia p 205 A83-23249
- FLOW CHARACTERISTICS**
- Certain effects and paradoxes in aerodynamics and hydraulics — Russian book p 229 A83-20379
- Embedded flow characteristics of sharp-edged rectangular wings p 190 A83-22152
- FLOW DISTORTION**
- Numerical calculation of the separation and connection of two-dimensional supersonic flows in channels with discontinuous boundaries p 212 A83-22658
- FLOW DISTRIBUTION**
- An analytical and experimental comparison of the flow field of an advanced swept turboprop [AIAA PAPER 83-0189] p 189 A83-21080
- Unsteady transonic flow over wings including inviscid/viscous interaction p 190 A83-22132
- Laser-Doppler velocimeter (LDV) measurements of the velocity field of a leading edge vortex over a delta wing before and after vortex breakdown [VKI-TN-142] p 192 N83-16300
- The wake of a sideslipping wing in low speed flow [VKI-TN-143] p 192 N83-16301
- A study of the flow around a slotted flap end [BU-279] p 192 N83-16306
- The aerodynamic performance of several flow control devices for internal flow systems [NASA-TP-1972] p 221 N83-17560
- FLOW VELOCITY**
- Laser-Doppler velocimeter (LDV) measurements of the velocity field of a leading edge vortex over a delta wing before and after vortex breakdown [VKI-TN-142] p 192 N83-16300
- FLUID DYNAMICS**
- Certain effects and paradoxes in aerodynamics and hydraulics — Russian book p 229 A83-20379
- Compressor cascade performance deterioration caused by sand ingestion [NASA-CR-168067] p 190 N83-16286
- FLUID MECHANICS**
- Simplified free wake analysis for rotors [FFA-TN-1982-07] p 195 N83-17518

- FLUTTER**
- The estimation method on flutter boundary from subcritical random responses due to air turbulences Problems of test procedures and data analysis [NAL-TR-718] p 217 N83-17554
- Structural testing for static failure, flutter and other scary things [NASA-TM-84606] p 234 N83-17899
- FLUTTER ANALYSIS**
- Flutter of orthotropic panels in supersonic flow using affine transformations p 228 A83-19821
- Flight test results of an active flutter suppression system p 216 A83-22164
- Eigenspace techniques for active flutter suppression [NASA-CR-169858] p 217 N83-17556
- FLY BY WIRE CONTROL**
- F-104 CCV research flight test program p 215 A83-20074
- FLYING PLATFORMS**
- Bo 105 rotor blade influence on the Calipso FLIR in the mast-mounted observation platform Ophelia p 205 A83-23249
- FOKKER AIRCRAFT**
- The on-board computer system for the F29 prototype flight test [NLR-MP-81034-U] p 209 N83-16339
- The F29 flight test instrumentation and data processing system An overview of requirements, design and organization [NLR-MP-81035-U] p 209 N83-16340
- FOOTPRINTS**
- Program to compute the positions of the aircraft and of the aircraft sensor footprints [E83-10139] p 234 N83-16814
- FORCED VIBRATION**
- Nonlinear forced oscillations of a rotating shaft carrying an unsymmetrical rotor at the major critical speed p 228 A83-20288
- FORECASTING**
- Oceanic Area System Improvement Study (OASIS) Volume 10 North Atlantic, Central East Pacific, and Caribbean regions aviation traffic forecasts [FAA-EM-81-17-VOL-10] p 201 N83-16322
- FRACTURE MECHANICS**
- Damage tolerance assessment of the A-7D aircraft structure p 204 A83-21771
- Progress in the practical applications of fracture mechanics p 230 A83-21796
- Practical application of fracture mechanics p 230 A83-21799
- FRACTURE STRENGTH**
- The effect of loading rates, temperature and moisture on the fracture toughness of polycarbonate p 223 A83-20497
- FRAMES**
- Service operation of a CFRP window frame in short fiber pressing [BMFT-FB-W-82-021] p 233 N83-17749
- FREE FLIGHT**
- Effective aerodynamic parameter evaluation from free flight tests p 203 A83-21005
- FREQUENCY STANDARDS**
- A demonstration of relative positioning using conventional GPS Doppler receivers p 199 A83-19779
- FRETING**
- Fatigue failure under fretting conditions p 224 A83-21481
- FUEL COMBUSTION**
- Effects of envelope flames on drop gasification rates in turbulent diffusion flames p 222 A83-19846
- Investigation of slurry fuel performance for use in a ramjet propulsor p 223 A83-21014
- FUEL CONSUMPTION**
- The automated cockpit p 208 A83-20849
- The Fokker F28 and a four-engined newcomer p 204 A83-21349
- PW 4000 - A radically new jet engine being developed in the USA p 212 A83-23239
- Symposium on Commercial Aviation Energy Conservation Strategies Papers and presentations [AD-A107106] p 188 N83-17455
- Potential fuel savings through improved airframe maintenance p 188 N83-17456
- Development of a procedure for calculating the effects of airfoil erosion on aircraft engine compressor performance p 213 N83-17457
- Aircraft towing feasibility study p 207 N83-17458
- An overview of the DOT/FAA aviation energy conservation policy p 235 N83-17460
- Flight preparation and planning p 188 N83-17462
- Fuel conservation techniques in jet transport aircraft operations p 198 N83-17463
- Air traffic control Its effect on fuel conservation p 202 N83-17464

- Computerized engine and airplane performance monitoring programs p 188 N83-17465
- Slidestip indication system p 210 N83-17466
- Turbine engine fuel conservation by fan and compressor profile control p 213 N83-17467
- A practical economic criterion for fuel conservation p 239 N83-17468
- Minimum-fuel turning climbout and descent guidance of transport jets [NASA-TM-84289] p 217 N83-17552
- FUEL SPRAYS**
- Effects of envelope flames on drop gasification rates in turbulent diffusion flames p 222 A83-19846
- FUEL TESTS**
- A rapid method for determining the initial boiling point and the saturated-vapor pressure of petroleum products — jet fuel tests in railroad tank cars p 229 A83-20962
- FUEL-AIR RATIO**
- Sooting tendency of fuels containing polycyclic aromatics in a research combustor p 225 A83-23138
- FUELS**
- An investigation of the effectiveness of smoke suppressant fuel additives for turbojet applications [AD-A121228] p 215 N83-17549
- FUSELAGES**
- Theoretical and experimental evaluation of transmission loss of cylinders — as idealized aircraft fuselages p 237 A83-19808
- A superelement analysis of stiffened shells — Russian book on aircraft fuselage structures p 202 A83-20392
- The development of advanced composite front fuselage technology p 202 A83-20464
- Fuselage-lifting surfaces interaction in unsteady subsonic flow — French thesis p 189 A83-22093
- Application of the matrix method of forces for the calculation of aircraft structures p 232 A83-23221
- Rotor-fuselage interference on engine internal aerodynamics in maneuvering high-speed rotorcraft p 193 N83-17480
- Studies on blade-to-blade and rotor-fuselage-tail interferences — in helicopters [MBB-351-82-O-E] p 195 N83-17521

G

- GAS MIXTURES**
- Coal gasification for stationary gas-turbine applications [DE82-902135] p 226 N83-16553
- GAS TURBINE ENGINES**
- Unbalance response analysis of a complete turbomachine p 228 A83-19674
- Effect of broad properties fuel on injector performance in a reverse flow combustor [AIAA PAPER 83-0154] p 210 A83-21079
- Cleaning gas turbine compressors - Some service experience with a wet-wash system p 210 A83-21350
- The corrosion resistance of protective coatings p 223 A83-21454
- High temperature stability of pack aluminate coatings on IN38LC p 230 A83-21459
- Fatigue and creep considerations in the design of turbine components p 230 A83-21461
- The interaction of high temperature corrosion and mechanical properties of alloys p 224 A83-21470
- Fatigue failure under fretting conditions p 224 A83-21481
- Evaluation of air-cooled Si3N4 vanes p 224 A83-22263
- A transonic quasi-3D analysis for gas turbine engines including split-flow capability for turbofans p 190 A83-22647
- Current problems in the testing of aircraft engines p 211 A83-22652
- Features of the selection of the basic parameters of cooled GTE turbines p 211 A83-22655
- Gas turbine combustor modelling for calculating pollutant emission p 212 A83-23142
- A method to estimate weight and dimensions of small aircraft propulsion gas turbine engines: User's guide [NASA-CR-168049] p 213 N83-16343
- Analytical and experimental investigation of turbine blade damping [AD-A120470] p 213 N83-16345
- Analysis of a MIL-L-27502 lubricant from a gas-turbine engine test by size-exclusion chromatography [NASA-TP-2063] p 226 N83-16528
- Sputtered ceramic coatings and sealing layers [DE82-005225] p 226 N83-16531
- Coal gasification for stationary gas-turbine applications [DE82-902135] p 226 N83-16553
- Equivalent damage A critical assessment [NASA-CR-167874] p 214 N83-17542
- Erosion of protective compressor coatings [NLR-MP-87067-U] p 228 N83-17716

- Experimental study of the thermal stability of hydrocarbon fuels [NASA-CR-168027] p 228 N83-17728
- Bearing fatigue investigation 3 [NASA-CR-168029] p 233 N83-17880
- GAS TURBINES**
- Water injection into compressors of gas turbines for power increase and reduction of NOX emission [BMFT-FB-T-82-075] p 233 N83-16765
- GASIFICATION**
- Effects of envelope flames on drop gasification rates in turbulent diffusion flames p 222 A83-19846
- GENERAL AVIATION AIRCRAFT**
- Low-speed aerodynamic characteristics of a 17-percent-thick medium speed airfoil designed for general aviation applications [NASA-TP-1786] p 191 N83-16290
- Computer program to predict noise of general aviation aircraft User's guide [NASA-CR-168050] p 238 N83-17242
- Research and technology program perspectives for general aviation and commuter aircraft [NASA-CR-169875] p 187 N83-17454
- Statistical summary Study to determine the IFR operational profile of the general aviation single pilot — instrument flight rules [NASA-CR-165805] p 198 N83-17523
- Structural testing for static failure, flutter and other scary things [NASA-TM-84606] p 234 N83-17899
- A pilot study of human response to general aviation aircraft noise [NASA-CR-166053] p 238 N83-18404
- GLOBAL POSITIONING SYSTEM**
- Fixed wing and rotary wing flight testing of Navstar GPS as a civilian navigation system p 199 A83-19777
- A demonstration of relative positioning using conventional GPS Doppler receivers p 199 A83-19779
- GOVERNMENT/INDUSTRY RELATIONS**
- Aeronautical research and technology policy Volume 1 Summary report p 187 N83-17452
- GRAPHITE-EPOXY COMPOSITES**
- Serviceability evaluation of advanced composite F-14A main-landing-gear-strut doors and overwing fairings p 185 A83-20480
- Demonstration of reparability and repair quality on graphite/epoxy structural subelements p 186 A83-20485
- Sonic fatigue of advanced composite panels in thermal environments p 224 A83-22166
- Graphite/epoxy material characteristics and design techniques for airborne instrument application p 225 A83-22595
- Repair techniques for graphite/epoxy structures for commercial transport applications [NASA-CR-159056] p 225 N83-16397
- GROUND SUPPORT SYSTEMS**
- USAF ground fiber optic development program p 228 A83-19711
- GROUND TESTS**
- Compact installation for testing vectored-thrust engines p 218 A83-22158
- Structural testing for static failure, flutter and other scary things [NASA-TM-84606] p 234 N83-17899
- GROUND TRACKS**
- Program to compute the positions of the aircraft and of the aircraft sensor footprints [E83-10139] p 234 N83-16814
- GUIDANCE (MOTION)**
- Evaluation of supplemental lights for caution bars [FAA-CT-82-119] p 220 N83-17559
- GUIDE VANES**
- A limited study of thrust vector control with guide vanes and jet rudder [FOA-C-20455-E3] p 221 N83-16386
- GUNS (ORDNANCE)**
- Thirty years of fighter armament p 203 A83-20600
- GYROSCOPES**
- Gyroscopic instruments and their application to flight testing [AGARD-AG-160-VOL-15] p 233 N83-17855

H

- HANG GLIDERS**
- An investigation and comparison of the aerodynamic performance of selected hang-glider airfoil sections [BU-276] p 192 N83-16305
- HEAD MOVEMENT**
- Vertical impact tests of a modified F/FB-111 crew seat to evaluate headrest position and restraint configuration effects [AD-A120255] p 197 N83-16311

HEAD-UP DISPLAYS

- Evaluation of helicopter pilot's attitude control using a simulated head-up display in a simulated helicopter cockpit [AD-A119570] p 219 N83-16355

HEAT RESISTANT ALLOYS

- High temperature stability of pack aluminate coatings on IN38LC p 230 A83-21459
- Fatigue and creep considerations in the design of turbine components p 230 A83-21461
- The interaction of high temperature corrosion and mechanical properties of alloys p 224 A83-21470
- The relationship between structure, properties and processing in powder metallurgy superalloys p 224 A83-21493
- Metallurgical instabilities during the high temperature low cycle fatigue of nickel-base superalloys p 224 A83-22019
- Coating with overlay metallic-cermet alloy systems [NASA-CASE-LEW-13639-2] p 227 N83-17683

HEATING EQUIPMENT

- Elevated temperature repairs of advanced composite structures p 223 A83-20499

HELICOPTER CONTROL

- Identification of certain dynamic characteristics of a helicopter-autopilot system by means of simulation p 216 A83-23222
- A control model for maneuvering flight for application to a computer flight testing program [NLR-MP-81046-U] p 207 N83-17531

HELICOPTER DESIGN

- The Hummercraft p 204 A83-21033
- Will technology make the helicopter competitive p 204 A83-21574
- Studies on an acceleration platform and at the time of a simulated crash of helicopter anticrash seats p 197 A83-22976
- Development of the basic methods needed to predict helicopters' aerelastic behaviour [ONERA, TP NO 1982-75] p 232 A83-23248
- First results for the definition of a general rotorcraft dynamic program p 236 N83-17483
- An interactive system for transformation of known measures long internal surface of cylinders model for shafts [ISD-294] p 233 N83-17748

HELICOPTER PERFORMANCE

- A simulation model for the analysis of the dynamic behavior of a helicopter rotor under nonstationary limit flight conditions p 204 A83-23220
- Methods used at Aerospatiale for calculating the loads on a rotor and experimental cross checks p 194 N83-17486

HELICOPTER WAKES

- Rotor hovering performance using the method of fast free wake analysis p 190 A83-22162
- Obscuration by helicopter-produced snow clouds p 197 A83-22357
- Velocity coupling A new concept for hover and axial flow wake analysis and design p 193 N83-17478
- Studies on blade-to-blade and rotor-fuselage-tail interferences p 193 N83-17479
- Development of the vortex ring wake model and its influence on the prediction of rotor loads p 194 N83-17481
- An appraisal of rotor blade-tip vortex interaction and wake geometry from flight measurements p 194 N83-17488

HELICOPTERS

- A concept for reducing helicopter IFR landing weather minimums - Onshore p 199 A83-21034
- Equivalent G/E of helicopter rotor blades — shear modulus to Young's modulus ratio p 230 A83-22151
- The calculation of separated flow at helicopter bodies [NASA-TM-76715] p 191 N83-16291
- A laboratory method for the analysis of helicopter underwing load oscillations [BU-273] p 192 N83-16303
- Desirable characteristics of underwater lights for helicopter escape hatches [AD-A120331] p 197 N83-16310
- Desirable characteristics of underwater lights for helicopter escape hatches [AD-A120510] p 198 N83-16312
- Survey of active and passive means to reduce rotorcraft vibrations [MBB-UD-350] p 206 N83-16335
- Helicopter fin effectiveness [BU-271] p 206 N83-16336
- Evaluation of helicopter pilot's attitude control using a simulated head-up display in a simulated helicopter cockpit [AD-A119570] p 219 N83-16355
- Prediction of Aerodynamic Loads on Rotorcraft — helicopter and wind turbine rotors [AGARD-CP-334] p 188 N83-17470

- Studies of aerofoils and blade tips for helicopters
p 193 N83-17473
- Prediction and experimental verification of the velocity fields of a rotor during hovering
p 193 N83-17477
- Rotor-fuselage interference on engine internal aerodynamics in maneuvering high-speed rotorcraft
p 193 N83-17480
- Simplified free wake analysis for rotors
[FFA-TN-1982-07]
p 195 N83-17518
- Transect effects on helicopter rotor blades
[MBB-349-81-O-E]
p 195 N83-17520
- Studies on blade-to-blade and rotor-fuselage-tail interferences — in helicopters
[MBB-351-82-O-E]
p 195 N83-17521
- The use of helicopters in Europe Analysis and prospects
[MBB-UD-359/82-O]
p 207 N83-17533
- Benefits assessment of active control technology and related cockpit technology for rotorcraft
[NASA-CR-166406]
p 217 N83-17553
- HIGH SPEED**
- Bearing fatigue investigation 3
[NASA-CR-168029]
p 233 N83-17880
- HIGH TEMPERATURE ENVIRONMENTS**
- Bearing fatigue investigation 3
[NASA-CR-168029]
p 233 N83-17880
- HIGH TEMPERATURE LUBRICANTS**
- Analysis of a MIL-L-27502 lubricant from a gas-turbine engine test by size-exclusion chromatography
[NASA-TP-2063]
p 226 N83-16528
- HIGH TEMPERATURE TESTS**
- Metallurgical instabilities during the high temperature low cycle fatigue of nickel-base superalloys
p 224 N83-22019
- HONEYCOMB CORES**
- Electrical discharge machining of aluminum honeycomb core
p 229 N83-20500
- HOT CORROSION**
- High temperature stability of pack aluminide coatings on IN38LC
p 230 N83-21459
- The interaction of high temperature corrosion and mechanical properties of alloys
p 224 N83-21470
- HOT PRESSING**
- Manufacturing processes for aeronautical structures
p 227 N83-17620
- HOT SURFACES**
- Sputtered ceramic coatings and sealing layers
[DE82-005225]
p 226 N83-16531
- HOVERING**
- Prediction of the aerodynamic loads on helicopter blades in hovering and axial flight using lifting line theory
p 189 N83-21016
- The aeroelastic behavior of curved helicopter blades in hovering and axial flight
p 203 N83-21017
- Rotor hovering performance using the method of fast free wake analysis
p 190 N83-22162
- Prediction and experimental verification of the velocity fields of a rotor during hovering
p 193 N83-17477
- Velocity coupling A new concept for hover and axial flow wake analysis and design
p 193 N83-17478
- HOVERING STABILITY**
- Dynamic stability of a buoyant quad-rotor aircraft
p 216 N83-22160
- HUBS**
- Comparison of rotor analysis results with aerodynamic windtunnel data
p 194 N83-17487
- HUMAN FACTORS ENGINEERING**
- Pilot task profiles, human factors, and image realism
p 219 N83-22836
- Computer based maintenance aids system Preliminary development and evaluation of a prototype
[AD-A120627]
p 187 N83-16281
- Applications of simulator freeze to carrier glideslope tracking instruction
[AD-A118862]
p 220 N83-16356
- Human Factors Aspects of Aircraft Accidents
[AGARD-LS-125]
p 188 N83-17490
- An overview of human factors in aircraft accidents and investigative techniques
p 198 N83-17491
- The influence of handling qualities, crashworthiness and other engineering factors on aircraft safety
p 198 N83-17493
- HUMAN REACTIONS**
- A pilot study of human response to general aviation aircraft noise
[NASA-CR-166053]
p 238 N83-18404
- HYDRAULICS**
- Certain effects and paradoxes in aerodynamics and hydraulics — Russian book
p 229 N83-20379
- HYDROCARBON COMBUSTION**
- Sooting tendency of fuels containing polycyclic aromatics in a research combustor
p 225 N83-23138
- HYDROGEN ENGINES**
- The ideas of F. A. Tsander and an assessment of the application of jet engines for the acceleration of aerospace vehicles
p 221 N83-22657

HYPERSONIC COMBUSTION

- On the choice of the optimal total wedge angle for the air intake of a hypersonic ramjet engine
p 212 N83-22656
- The ideas of F. A. Tsander and an assessment of the application of jet engines for the acceleration of aerospace vehicles
p 221 N83-22657
- HYPERSONIC HEAT TRANSFER**
- The effect of the nonuniformity of supersonic flow with shocks on friction and heat transfer in the channel of a hypersonic ramjet engine
p 211 N83-22654
- HYPERSONIC SHOCK**
- The effect of the nonuniformity of supersonic flow with shocks on friction and heat transfer in the channel of a hypersonic ramjet engine
p 211 N83-22654
- HYPERSONIC WIND TUNNELS**
- Sound shield
[NASA-CASE-LAR-12883-1]
p 237 N83-17235
- ICE FORMATION**
- Microwave Ice Accretion Measurement Instrument /MIAMI/
p 208 N83-22163
- Ignition
- Anti-misting additives for jet fuels
[NASA-CR-169751]
p 225 N83-16417
- ILLUMINATING**
- Desirable characteristics of underwater lights for helicopter escape hatches
[AD-A120510]
p 198 N83-16312
- IMAGE MOTION COMPENSATION**
- Bo 105 rotor blade influence on the Calipso FLIR in the mast-mounted observation platform Ophelia
p 205 N83-23249
- IMAGE PROCESSING**
- Computer-generated images in visual simulation and avionics technologies
p 219 N83-22835
- Thermal infrared pushbroom imagery acquisition and processing — of NASA's Advanced Land Observing System
p 209 N83-22841
- IMPACT ACCELERATION**
- Vertical impact tests of a modified F/EB-111 crew seat to evaluate headrest position and restraint configuration effects
[AD-A120255]
p 197 N83-16311
- IMPACT DAMAGE**
- Predicted and measured landing gear loads for the NF-5 aircraft taxiing over a bumpy runway
[NLR-MP-82008-U]
p 207 N83-17532
- IMPACT RESISTANCE**
- A new high impact resin system for advanced composites with 300 F / 150 C / properties
p 222 N83-20429
- Materials screening tests of the FOD impact design technology program, task 4C — fan and compressor blades for aircraft engines
[AD-A119839]
p 225 N83-16401
- IMPACT TESTS**
- Vertical impact tests of a modified F/EB-111 crew seat to evaluate headrest position and restraint configuration effects
[AD-A120255]
p 197 N83-16311
- IN-FLIGHT MONITORING**
- The MCA method, a flight test technique to determine the thrust of jet aircraft in flight — Mass Consumption Acceleration
p 202 N83-19661
- Computerized engine and airplane performance monitoring programs
p 188 N83-17465
- INCOMPRESSIBLE FLOW**
- Aerosound from corner flow and flap flow
[AIAA PAPER 81-2039]
p 237 N83-19813
- INDICATING INSTRUMENTS**
- Slideslip indication system
p 210 N83-17466
- INDUSTRIAL MANAGEMENT**
- Research and technology program perspectives for general aviation and commuter aircraft
[NASA-CR-169875]
p 187 N83-17454
- INERTIAL NAVIGATION**
- Suboptimal filters for INS alignment on a moving base
p 199 N83-21019
- INERTIAL PLATFORMS**
- Gyroscopic instruments and their application to flight testing
[AGARD-AG-160-VOL-15]
p 233 N83-17855
- INFORMATION DISSEMINATION**
- Computerized engine and airplane performance monitoring programs
p 188 N83-17465
- INFORMATION SYSTEMS**
- Computer based maintenance aids system: Preliminary development and evaluation of a prototype
[AD-A120627]
p 187 N83-16281
- INFRARED ABSORPTION**
- Obscuration by helicopter-produced snow clouds
p 197 N83-22357

INFRARED DETECTORS

- Infrared calibration facilities at Newark Air Force Station
p 219 N83-22875
- Electro-optical calibration considerations at intermediate maintenance levels
p 232 N83-22883
- INFRARED IMAGERY**
- Stimulus variables affecting dynamic target acquisition
p 209 N83-22590
- Thermal infrared pushbroom imagery acquisition and processing — of NASA's Advanced Land Observing System
p 209 N83-22841
- Bo 105 rotor blade influence on the Calipso FLIR in the mast-mounted observation platform Ophelia
p 205 N83-23249
- INFRARED LASERS**
- Infrared calibration facilities at Newark Air Force Station
p 219 N83-22875
- INFRARED RADIOMETERS**
- Electro-optical calibration considerations at intermediate maintenance levels
p 232 N83-22883
- Calibration support of the AN/AAM-60 common forward-looking infrared /FLIR/ test bench
p 232 N83-22886
- INFRARED SCANNERS**
- Future trends in the use of infrared line scanners for airborne reconnaissance
p 209 N83-22578
- Thermal infrared pushbroom imagery acquisition and processing — of NASA's Advanced Land Observing System
p 209 N83-22841
- INGESTION (ENGINES)**
- Materials screening tests of the FOD impact design technology program, task 4C — fan and compressor blades for aircraft engines
[AD-A119839]
p 225 N83-16401
- INJECTORS**
- Effect of broad properties fuel on injector performance in a reverse flow combustor
[AIAA PAPER 83-0154]
p 210 N83-21079
- INSTRUMENT FLIGHT RULES**
- A concept for reducing helicopter IFR landing weather minimums - Onshore
p 199 N83-21034
- Statistical summary Study to determine the IFR operational profile of the general aviation single pilot — instrument flight rules
[NASA-CR-165805]
p 198 N83-17523
- INTERFERENCE DRAG**
- Studies on blade-to-blade and rotor-fuselage-tail interferences — in helicopters
[MBB-351-82-O-E]
p 195 N83-17521
- INTERNAL COMBUSTION ENGINES**
- Vibration-free internal combustion engine for general aviation
[BMFT-FW-W82-016]
p 213 N83-16347
- INVISID FLOW**
- Finite difference calculation of an inviscid transonic flow over oscillating airfoils
[RAE-TRANS-2087]
p 191 N83-16292
- J**
- JET AIRCRAFT**
- The MCA method, a flight test technique to determine the thrust of jet aircraft in flight — Mass Consumption Acceleration
p 202 N83-19661
- Computer-enhanced analysis of a jet in a cross stream
p 228 N83-19804
- Oceanic Area System Improvement Study (OASIS) Volume 10 North Atlantic, Central East Pacific, and Caribbean regions aviation traffic forecasts
[FAA-EM-81-17-VOL-10]
p 201 N83-16322
- JET AIRCRAFT NOISE**
- Effect of excitation on coaxial jet noise
p 237 N83-19811
- Screech suppression in supersonic jets
p 237 N83-19814
- Radiation from a double layer jet — aerodynamic noise
p 237 N83-20364
- Comparison of forward flight effects theory of A. Michalke and U. Michel with measured data
[NASA-CR-3665]
p 238 N83-17239
- USAF Environmental Noise Data Handbook. Volume 150 C-140 in-flight crew noise
[AD-A120508]
p 238 N83-17246
- JET CONTROL**
- A limited study of thrust vector control with guide vanes and jet rudder
[FOA-C-20455-E3]
p 221 N83-16386
- JET ENGINE FUELS**
- Effects of envelope flames on drop gasification rates in turbulent diffusion flames
p 222 N83-19846
- Fuel for future transport aircraft
p 222 N83-20082
- A rapid method for determining the initial boiling point and the saturated-vapor pressure of petroleum products — jet fuel tests in railroad tank cars
p 229 N83-20962

- Sooting tendency of fuels containing polycyclic aromatics in a research combustor p 225 A83-23138
- Anti-misting additives for jet fuels [NASA-CR-169751] p 225 N83-16417
- Viscometric and misting properties of polymer-modified fuel [NASA-CR-169750] p 226 N83-16543
- Potential fuel savings through improved airframe maintenance p 188 N83-17456

JET ENGINES

- Effects of cobalt in nickel-base superalloys p 223 A83-21467
- Material characterization Part B. Mechanical properties of 2 metal matrix composite materials [AD-A119829] p 225 N83-16402
- The JT9D Jet Engine Diagnostics Program [NASA-CR-167966] p 214 N83-17544
- Erosion of protective compressor coatings [NLR-MP-87067-U] p 228 N83-17716

JET EXHAUST

- Theory of resistance interference of airfoil wings and engine exhaust p 188 A83-19667
- Conventional profile coaxial jet noise prediction p 237 A83-22128

JET FLAPS

- The application of parameter estimation to flight measurements to obtain lateral-directional stability derivatives of an augmented jet-flap STOL airplane [NASA-TP-2033] p 216 N83-16350

K**KEROSENE**

- Investigation of slurry fuel performance for use in a ramjet propulsor p 223 A83-21014

KINEMATICS

- First results for the definition of a general rotorcraft dynamic program p 236 N83-17483
- Review of rotor loads prediction methods p 194 N83-17484

L**LAMINAR FLOW**

- Evaluation of laminar flow control systems for subsonic commercial transport aircraft Executive summary [NASA-CR-159252] p 216 N83-17551

LAMINATES

- Graphite/epoxy material characteristics and design techniques for airborne instrument application p 225 A83-22595
- Manufacturing processes for aeronautical structures p 227 N83-17620

LAND USE

- Airport community soundproofing and relocation study [PB82-259144] p 220 N83-16358
- Airport noise Land-use compatibility by the year 2000 [PB82-259151] p 220 N83-16359

LANDING AIDS

- Development of the precision approach path indicator light unit [RAE-TM-FS(B)-483] p 202 N83-17527

LANDING GEAR

- Serviceability evaluation of advanced composite F-14A main-landing-gear-strut doors and overwing fairings p 185 A83-20480

LANDING LOADS

- Predicted and measured landing gear loads for the NF-5 aircraft taxiing over a bumpy runway [NLR-MP-82008-U] p 207 N83-17532

LANDING SIMULATION

- Realistic 'feel' in flight simulator is based on precise control loading p 219 A83-23240

LASER APPLICATIONS

- Lasers in aviation — Russian book p 229 A83-20384
- Laser and millimeter-wave backscatter of transmission cables p 199 A83-22523

LASER DOPPLER VELOCIMETERS

- An analytical and experimental comparison of the flow field of an advanced swept turboprop [AIAA PAPER 83-0189] p 189 A83-21080

LASER OUTPUTS

- Infrared calibration facilities at Newark Air Force Station p 219 A83-22875

LASER RANGE FINDERS

- Multifunction CO₂ laser radar technology p 208 A83-22502
- Adaptive detection of targets in laser speckle noise p 208 A83-22521

LATERAL STABILITY

- The application of parameter estimation to flight measurements to obtain lateral-directional stability derivatives of an augmented jet-flap STOL airplane [NASA-TP-2033] p 216 N83-16350

LATTICES (MATHEMATICS)

- Subsonic steady and unsteady aerodynamic loads on missiles and aircraft [NASA-CR-169749] p 190 N83-16284

LEADING EDGE THRUST

- An appraisal of rotor blade-tip vortex interaction and wake geometry from flight measurements p 194 N83-17488

LEADING EDGES

- Laser-Doppler velocimeter (LDV) measurements of the velocity field of a leading edge vortex over a delta wing before and after vortex breakdown [VKI-TN-142] p 192 N83-16300

LIFE CYCLE COSTS

- Setting design goals for advanced propulsion systems [AIAA PAPER 81-1505] p 211 A83-22154

LIFE SUPPORT SYSTEMS

- Human Factors Aspects of Aircraft Accidents [AGARD-LS-125] p 188 N83-17490

LIFT

- Subsonic steady and unsteady aerodynamic loads on missiles and aircraft [NASA-CR-169749] p 190 N83-16284
- Development of aerodynamic prediction methods for irregular planform wings [NASA-CR-3664] p 195 N83-17515
- Analysis of oscillatory motion of a light airplane at high values of lift coefficient [NASA-TM-84563] p 216 N83-17550

LIFT DEVICES

- Design, analyses, and model tests of an aeroelastically tailored lifting surface p 204 A83-22155

LIGHT AIRCRAFT

- A study of optimum cowl shapes and flow port locations for minimum drag with effective engine cooling, volume 1 [NASA-CR-159379] p 191 N83-16288
- A study of optimum cowl shapes and flow port locations for minimum drag with effective engine cooling, volume 2 [NASA-CR-159380] p 191 N83-16289
- Analysis of oscillatory motion of a light airplane at high values of lift coefficient [NASA-TM-84563] p 216 N83-17550
- Structural testing for static failure, flutter and other scary things [NASA-TM-84606] p 234 N83-17899

LIGHT TRANSMISSION

- Obscuration by helicopter-produced snow clouds p 197 A83-22357

LIGHTNING

- Observations of optical lightning emissions from above thunderstorms using U-2 aircraft p 234 A83-22703

LININGS

- Eigensolutions for liners in uniform mean flow ducts p 237 A83-19810

LIQUID FUELS

- Fuel for future transport aircraft p 222 A83-20082
- Performance of high-altitude, long-endurance, turboprop airplanes using conventional or cryogenic fuels [NASA-TM-84534] p 207 N83-17530

LIQUID HYDROGEN

- Fuel for future transport aircraft p 222 A83-20082

LOADING OPERATIONS

- A laboratory method for the analysis of helicopter underslung load oscillations [BU-273] p 192 N83-16303

LOADS (FORCES)

- Development of the vortex ring wake model and its influence on the prediction of rotor loads p 194 N83-17481
- Review of rotor loads prediction methods p 194 N83-17484

- The development of a system for interdisciplinary analysis of rotorcraft flight characteristics p 236 N83-17485

- Comparison of rotor analysis results with aerodynamic windtunnel data p 194 N83-17487

- DATAMAP and its impact on prediction programs p 236 N83-17489

- Force imitations in helicopter rotor blades, wind channel fans and wind turbines [MBB-UD-356-82-0] p 196 N83-17522

- Performance of high-altitude, long-endurance, turboprop airplanes using conventional or cryogenic fuels [NASA-TM-84534] p 207 N83-17530

LOGISTICS

- United States Air Force tactical reconnaissance - An analysis and commentary p 186 A83-22574

LONGITUDINAL CONTROL

- Investigation of the longitudinal motion of a flight vehicle by the method of the separation of motions p 215 A83-20144

- Application of vector performance optimization to a robust control loop design for a fighter aircraft p 215 A83-21160

LONGITUDINAL STABILITY

- Investigation of the longitudinal motion of a flight vehicle by the method of the separation of motions p 215 A83-20144

LOW ASPECT RATIO WINGS

- The wake of a sideslipping wing in low speed flow [VKI-TN-143] p 192 N83-16301

LOW SPEED

- Low-speed aerodynamic characteristics of a 17-percent-thick medium speed airfoil designed for general aviation applications [NASA-TP-1786] p 191 N83-16290

- The wake of a sideslipping wing in low speed flow [VKI-TN-143] p 192 N83-16301

LOW SPEED WIND TUNNELS

- A wind tunnel for unsteady turbulent shear flows - Design and flow calculation p 218 A83-19664

LOW TEMPERATURE TESTS

- The effect of primer-adhesive compatibility on adhesive peel strength at low temperature p 222 A83-20448

LUBRICANTS

- Evaluation of lubricants for air compressors [PB82-259003] p 226 N83-16538

M**MACHINING**

- Automated machining of turbine blades by Rolls-Royce p 229 A83-21348

MAINTAINABILITY

- Serviceability evaluation of advanced composite F-14A main-landing-gear-strut doors and overwing fairings p 185 A83-20480

MAINTENANCE

- Maintenance of airport visual aid facilities Advisory circular [AC-150-5340-26] p 219 N83-16352

MAN MACHINE SYSTEMS

- An optimal control approach to the design of moving flight simulators p 218 A83-19949
- Benefits assessment of active control technology and related cockpit technology for rotorcraft [NASA-CR-166406] p 217 N83-17553

MANAGEMENT PLANNING

- The engineering investigation of aircraft accidents p 198 N83-17497

MANEUVERABILITY

- Advanced composite materials in aerobatic aircraft p 203 A83-20496
- Aircraft maneuver mechanics with turning of the power-plant thrust vector p 216 A83-22076
- A control model for maneuvering flight for application to a computer flight testing program [NLR-MP-81046-U] p 207 N83-17531

MANUFACTURING

- Manufacturing processes for aeronautical structures p 227 N83-17620

MASS FLOW

- The MCA method, a flight test technique to determine the thrust of jet aircraft in flight — Mass Consumption Acceleration p 202 A83-19661

MATERIALS SCIENCE

- Specific examples of aerospace applications of composites p 227 N83-17621

MATERIALS TESTS

- Eddy current impedance plane analysis p 231 A83-22410

MATHEMATICAL PROGRAMMING

- Initial design of stringer stiffened bend boxes using geometric programming p 232 A83-23149

MATRIX MATERIALS

- Material characterization Part B Mechanical properties of 2 metal matrix composite materials [AD-A119829] p 225 N83-16402

MATRIX METHODS

- Application of the matrix method of forces for the calculation of aircraft structures p 232 A83-23221

MEASURING INSTRUMENTS

- Microwave Ice Accretion Measurement Instrument /MIAMI/ p 208 A83-22163

MECHANICAL DRIVES

- Evaluation of lubricants for air compressors [PB82-259003] p 226 N83-16538

MECHANICAL ENGINEERING

- Israel Conference on Mechanical Engineering, 16th, Technion - Israel Institute of Technology, Haifa, Israel, July 13, 14, 1982, Proceedings p 231 A83-22318

MECHANICAL PROPERTIES

- Effects of cobalt in nickel-base superalloys p 223 A83-21467
- The relationship between structure, properties and processing in powder metallurgy superalloys p 224 A83-21493
- Graphite/epoxy material characteristics and design techniques for airborne instrument application p 225 A83-22595
- Material characterization Part B Mechanical properties of 2 metal matrix composite materials [AD-A119829] p 225 N83-16402
- METAL BONDING**
- Service history of phosphoric acid anodized aluminum structure — with adhesive bonding for aircraft construction p 185 A83-20479
- METAL FATIGUE**
- The interaction of high temperature corrosion and mechanical properties of alloys p 224 A83-21470
- Practical application of a model for fatigue damage with irregular cyclic loading p 224 A83-21757
- An improved methodology for predicting random spectrum load interaction effects on fatigue crack growth p 224 A83-21802
- Metallurgical instabilities during the high temperature low cycle fatigue of nickel-base superalloys p 224 A83-22019
- METAL SURFACES**
- Coating with overlay metallic-cermet alloy systems [NASA-CASE-LEW-13639-2] p 227 N83-17683
- METAL WORKING**
- Manufacturing processes for aeronautical structures p 227 N83-17620
- METAL-METAL BONDING**
- The effect of primer-adhesive compatibility on adhesive peel strength at low temperature p 222 A83-20448
- Primary bonded aircraft wing construction p 186 A83-20493
- METAL-WATER REACTIONS**
- Effect of moisture on adhesively bonded titanium structures p 222 A83-20442
- METEOROLOGICAL RADAR**
- Cockpit weather radar display demonstrator and ground-to-air sensors telemetry system [NASA-CR-169830] p 210 N83-17534
- METRIC PHOTOGRAPHY**
- Program to compute the positions of the aircraft and of the aircraft sensor footprints [E83-10139] p 234 N83-16814
- MICROCOMPUTERS**
- Computers in avionics systems [NLR-MP-81063-U] p 236 N83-18291
- MICROELECTRONICS**
- Computers in avionics systems [NLR-MP-81063-U] p 236 N83-18291
- MICROPROCESSORS**
- Real-time multiradar simulation with a multiprocessor p 200 A83-22824
- Distributed micro-processor applications to guidance and control systems [AGARD-AR-178] p 236 N83-18295
- Microprocessor applications to guidance and control architectures p 236 N83-18297
- MICROSTRUCTURE**
- The relationship between structure, properties and processing in powder metallurgy superalloys p 224 A83-21493
- MICROWAVE EQUIPMENT**
- Microwave Ice Accretion Measurement Instrument /MIAMI/ p 208 A83-22163
- MIDAIR COLLISIONS**
- Problems of representation of air traffic controllers in mid-air litigation p 239 A83-21547
- MILITARY AIR FACILITIES**
- Infrared calibration facilities at Newark Air Force Station p 219 A83-22875
- MILITARY AIRCRAFT**
- Lasers in aviation — Russian book p 229 A83-20384
- Equivalency evaluation of firefighting agents and minimum requirements at US Air Force airfields [FAA-CT-82-109] p 198 N83-17524
- MILITARY OPERATIONS**
- CTOL, STOAL, V/STOL - An operational comparison for forward deployed CVNs p 196 A83-22157
- United States Air Force tactical reconnaissance - An analysis and commentary p 186 A83-22574
- Real-time reconnaissance - A systems look at advanced technology p 200 A83-22576
- CINNA - A system for preparing reconnaissance missions p 200 A83-22591
- MILITARY TECHNOLOGY**
- USAF ground fiber optic development program p 228 A83-19711
- Multifunction CO2 laser radar technology p 208 A83-22502

- Advanced tactical air reconnaissance system p 186 A83-22575
- Reconnaissance of the year 2000 and beyond p 186 A83-22577
- Future trends in the use of infrared line scanners for airborne reconnaissance p 209 A83-22578
- MILLIMETER WAVES**
- Laser and millimeter-wave backscatter of transmission cables p 199 A83-22523
- MISSILE TRAJECTORIES**
- General basic concepts for a trajectory simulation of a guided missile [PML-1981-36] p 221 N83-17574
- MISSION PLANNING**
- CTOL, STOAL, V/STOL - An operational comparison for forward deployed CVNs p 196 A83-22157
- CINNA - A system for preparing reconnaissance missions p 200 A83-22591
- MODULUS OF ELASTICITY**
- Equivalent G/E of helicopter rotor blades — shear modulus to Young's modulus ratio p 230 A83-22151
- MOISTURE CONTENT**
- Effect of moisture on adhesively bonded titanium structures p 222 A83-20442
- The effect of loading rates, temperature and moisture on the fracture toughness of polycarbonate p 223 A83-20497
- MOLDING MATERIALS**
- Manufacturing processes for aeronautical structures p 227 N83-17620
- MONOPULSE RADAR**
- Performance analysis of a dwell-time processor for monopulse beacon radars p 200 A83-22726
- Reply correlation test analysis in monopulse beacon radars p 200 A83-22727
- MOVING TARGET INDICATORS**
- Stimulus variables affecting dynamic target acquisition p 209 A83-22590
- Mode S baseline radar tracking [FAA-RD-82-53] p 233 N83-17770
- MULTIENGINE VEHICLES**
- The Fokker F28 and a four-engined newcomer p 204 A83-21349
- MULTIPROCESSING (COMPUTERS)**
- Real-time multiradar simulation with a multiprocessor p 200 A83-22824
- MULTISPECTRAL BAND SCANNERS**
- Spatial calibration of a multispectral data base — of airborne scanner systems p 209 A83-22882

N

- NACELLES**
- A study of optimum cowl shapes and flow port locations for minimum drag with effective engine cooling, volume 1 [NASA-CR-159379] p 191 N83-16288
- NATIONAL AVIATION SYSTEM**
- The development of standards for the common ICAO Data Interchange Network /CIDIN/ p 230 A83-22027
- NAVIGATION**
- Evaluation of retroreflective pavement markers for precision and nonprecision runways [FAA-CT-82-112] p 220 N83-17558
- Evaluation of supplemental lights for caution bars [FAA-CT-82-119] p 220 N83-17559
- NAVSTAR SATELLITES**
- Fixed wing and rotary wing flight testing of Navstar GPS as a civilian navigation system p 199 A83-19777
- NEAR FIELDS**
- Computer program to predict noise of general aviation aircraft. User's guide [NASA-CR-168050] p 238 N83-17242
- NEAR WAKES**
- Velocity coupling A new concept for hover and axial flow wake analysis and design p 193 N83-17478
- NETWORK SYNTHESIS**
- Extended perfect model following — control system synthesis technique p 235 A83-20289
- NICKEL ALLOYS**
- Effects of cobalt in nickel-base superalloys p 223 A83-21467
- Metallurgical instabilities during the high temperature low cycle fatigue of nickel-base superalloys p 224 A83-22019
- Creep and fatigue interactions in a nickel base superalloy [NLR-MP-82003-U] p 234 N83-17903
- NITROGEN OXIDES**
- Water injection into compressors of gas turbines for power increase and reduction of NOX emission [BMFT-FB-82-075] p 233 N83-16765
- NOISE GENERATORS**
- Aerosound from corner flow and flap flow [AIAA PAPER 81-2039] p 237 A83-19813

NOISE PREDICTION (AIRCRAFT)

- Conventional profile coaxial jet noise prediction p 237 A83-22128
- High bypass ratio engine noise component separation by coherence technique p 211 A83-22159
- Theoretical and experimental study of helicopter rotor noise [ONERA, TP NO 1982-74] p 205 A83-23247
- Airport noise Land-use compatibility by the year 2000 [PB82-259151] p 220 N83-16359
- Comparison of forward flight effects theory of A Michalke and U Michel with measured data [NASA-CR-3665] p 238 N83-17239
- Computer program to predict noise of general aviation aircraft: User's guide [NASA-CR-168050] p 238 N83-17242
- NOISE REDUCTION**
- Theoretical and experimental evaluation of transmission loss of cylinders — as idealized aircraft fuselages p 237 A83-19808
- Screech suppression in supersonic jets p 237 A83-19814
- Acoustic environment in large enclosures with a small opening exposed to flow p 237 A83-22161
- Airport community soundproofing and relocation study [PB82-259144] p 220 N83-16358
- Airport noise Land-use compatibility by the year 2000 [PB82-259151] p 220 N83-16359
- Sound shield [NASA-CASE-LAR-12883-1] p 237 N83-17235
- Effects of flight on noise radiated from convected ring sources in coaxial dual flow Part 2 The noise from heated jets [NASA-CR-169736] p 238 N83-17237
- The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations — (Los Angeles) p 202 N83-17459
- NOISE SPECTRA**
- Effect of excitation on coaxial jet noise p 237 A83-19811
- NOISE TOLERANCE**
- A pilot study of human response to general aviation aircraft noise [NASA-CR-166053] p 238 N83-18404
- NOMOGRAPHS**
- Computer-enhanced analysis of a jet in a cross stream p 228 A83-19804
- NONDESTRUCTIVE TESTS**
- Eddy current impedance plane analysis p 231 A83-22410
- NONLINEAR SYSTEMS**
- Numerical calculations of nonlinear aerodynamics of wing-body configurations p 189 A83-21022
- Practical application of a model for fatigue damage with irregular cyclic loading p 224 A83-21757
- Aeroelastic equilibrium of an helicopter rotor with nonlinear aerodynamic forces p 235 N83-17482
- NONLINEARITY**
- General purpose flight simulation program (FSPK-1) Part 1 Contents of the program [NAL-TR-702] p 207 N83-17529
- NONSTABILIZED OSCILLATION**
- Nonlinear forced oscillations of a rotating shaft carrying an unsymmetrical rotor at the major critical speed p 228 A83-20288
- NONUNIFORM FLOW**
- The effect of the nonuniformity of supersonic flow with shocks on friction and heat transfer in the channel of a hypersonic ramjet engine p 211 A83-22654
- NOZZLE DESIGN**
- Internal performance prediction for advanced exhaust systems — for tactical aircraft p 211 A83-22156
- NOZZLE GEOMETRY**
- Effect of excitation on coaxial jet noise p 237 A83-19811
- Screech suppression in supersonic jets p 237 A83-19814
- OCEANS**
- Oceanic Area System Improvement Study (OASIS) Volume 1 Executive summary and improvement alternatives development and analysis [FAA-EM-81-17-VOL-1] p 200 N83-16314
- ONBOARD DATA PROCESSING**
- Automation of on-board flightpath management p 215 A83-21002
- An on-board near-optimal climb-dash energy management [NASA-CR-169755] p 205 N83-16329
- OPERATING COSTS**
- The Fokker F28 and a four-engined newcomer p 204 A83-21349

- Will technology make the helicopter competitive
p 204 A83-21574
- Oceanic Area System Improvement Study (OASIS)
Volume 7 North Atlantic region flight cost model results
[FAA-EM-81-17-VOL-7] p 201 N83-16319
- Oceanic Area System Improvement Study (OASIS)
Volume 8 Central East Pacific region flight cost model results
[FAA-EM-81-17-VOL-8] p 201 N83-16320
- Oceanic Area System Improvement Study (OASIS)
Volume 9 Flight cost model description
[FAA-EM-81-17-VOL-9] p 201 N83-16321
- OPERATING TEMPERATURE**
Experimental study of the thermal stability of hydrocarbon fuels
[NASA-CR-168027] p 228 N83-17728
- OPERATIONAL PROBLEMS**
Current problems in the testing of aircraft engines
p 211 A83-22652
- OPTICAL COMMUNICATION**
USAF ground fiber optic development program
p 228 A83-19711
- OPTICAL MEASURING INSTRUMENTS**
Fiber optics for aircraft engine/inlet control
p 211 A83-22494
- OPTICAL PATHS**
Analysis of aero-optic interface phenomena
p 190 A83-22588
- OPTICAL RADAR**
Multifunction CO2 laser radar technology
p 208 A83-22502
- Adaptive detection of targets in laser speckle noise
p 208 A83-22521
- OPTICAL WAVEGUIDES**
Fiber optics for electro-magnetic pulse /EMP/ simulators
p 218 A83-22495
- OPTIMAL CONTROL**
An optimal control approach to the design of moving flight simulators
p 218 A83-19949
- Extended perfect model following — control system synthesis technique
p 235 A83-20289
- An on-board near-optimal climb-dash energy management
[NASA-CR-169755] p 205 N83-16329
- OPTIMIZATION**
On the choice of the optimal total wedge angle for the air intake of a hypersonic ramjet engine
p 212 A83-22656
- Optimal short-range trajectories for helicopters
[NASA-TM-84303] p 187 N83-17451
- ORTHOTROPIC PLATES**
Flutter of orthotropic panels in supersonic flow using affine transformations
p 228 A83-19821
- OSCILLATING FLOW**
A wind tunnel for unsteady turbulent shear flows - Design and flow calculation
p 218 A83-19664
- OSCILLATIONS**
Finite difference calculation of an inviscid transonic flow over oscillating airfoils
[RAE-TRANS-2087] p 191 N83-16292
- A laboratory method for the analysis of helicopter underwing load oscillations
[BU-273] p 192 N83-16303
- Analysis of oscillatory motion of a light airplane at high values of lift coefficient
[NASA-TM-84563] p 216 N83-17550
- P**
- PACIFIC OCEAN**
Oceanic Area System Improvement Study (OASIS)
Volume 3 Central East Pacific region air traffic services system description
[FAA-EM-81-17-VOL-3] p 201 N83-16316
- Oceanic Area System Improvement Study (OASIS)
Volume 5 North Atlantic, Central East Pacific, and Caribbean regions communication systems description
[FAA-EM-81-17-VOL-5] p 201 N83-16318
- Oceanic Area System Improvement Study (OASIS)
Volume 8 Central East Pacific region flight cost model results
[FAA-EM-81-17-VOL-8] p 201 N83-16320
- Oceanic Area System Improvement Study (OASIS)
Volume 9 Flight cost model description
[FAA-EM-81-17-VOL-9] p 201 N83-16321
- Oceanic Area System Improvement Study (OASIS)
Volume 10 North Atlantic, Central East Pacific, and Caribbean regions aviation traffic forecasts
[FAA-EM-81-17-VOL-10] p 201 N83-16322
- PANEL FLUTTER**
Flutter of orthotropic panels in supersonic flow using affine transformations
p 228 A83-19821
- PANEL METHOD (FLUID DYNAMICS)**
Numerical calculations of nonlinear aerodynamics of wing-body configurations
p 189 A83-21022

PANELS

- A sensible approach to process control of adhesive bonding
p 185 A83-20432
- PANORAMIC CAMERAS**
Analysis of target coverage for an unstabilized 35 mm panoramic strike camera
p 231 A83-22596
- PARAMETER IDENTIFICATION**
The application of parameter estimation to flight measurements to obtain lateral-directional stability derivatives of an augmented jet-flap STOL airplane
[NASA-TP-2033] p 216 N83-16350
- PASSENGER AIRCRAFT**
Primary bonded aircraft wing construction
p 186 A83-20493
- In-flight aircraft seat fire extinguishing tests (cabin hazard measurements)
[FAA-CT-82-111] p 197 N83-16308
- Oceanic Area System Improvement Study (OASIS)
Volume 10 North Atlantic, Central East Pacific, and Caribbean regions aviation traffic forecasts
[FAA-EM-81-17-VOL-10] p 201 N83-16322
- Study of advanced rotary combustion engines for commuter aircraft
[NASA-CR-165399] p 214 N83-17545
- PAVEMENTS**
Prediction of pavement roughness
[AD-A120009] p 232 N83-16566
- Predicted and measured landing gear loads for the NF-5 aircraft taxiing over a bumpy runway
[NLR-MP-82008-U] p 207 N83-17532
- Evaluation of retroreflective pavement markers for precision and nonprecision runways
[FAA-CT-82-112] p 220 N83-17558
- PEELING**
The effect of primer-adhesive compatibility on adhesive peel strength at low temperature
p 222 A83-20448
- PERFORMANCE PREDICTION**
An improved methodology for predicting random spectrum load interaction effects on fatigue crack growth
p 224 A83-21802
- Internal performance prediction for advanced exhaust systems — for tactical aircraft
p 211 A83-22156
- Rotor hovering performance using the method of fast free wake analysis
p 190 A83-22162
- Advances in high-speed rolling-element bearings — for aircraft engine and transmission application
p 231 A83-22319
- Blade erosion effects on aircraft-engine compressor performance
[DE82-021791] p 213 N83-16346
- The development of a system for interdisciplinary analysis of rotorcraft flight characteristics
p 236 N83-17485
- PERFORMANCE TESTS**
Calibration support of the AN/AAM-60 common forward-looking infrared /FLIR/ test bench
p 232 A83-22886
- PETROLEUM PRODUCTS**
A rapid method for determining the initial boiling point and the saturated-vapor pressure of petroleum products — jet fuel tests in railroad tank cars
p 229 A83-20962
- PHASE DIAGRAMS**
Effects of cobalt in nickel-base superalloys
p 223 A83-21467
- PHOSPHORIC ACID**
Service history of phosphoric acid anodized aluminum structure — with adhesive bonding for aircraft construction
p 185 A83-20479
- PHOTORECONNAISSANCE**
Analysis of target coverage for an unstabilized 35 mm panoramic strike camera
p 231 A83-22596
- PHYSIOLOGICAL FACTORS**
Multiple-event airplane noise annoyance
[NASA-TP-2101] p 234 N83-16951
- PILOT PERFORMANCE**
Applications of simulator freeze to carrier glideslope tracking instruction
[AD-A118862] p 220 N83-16356
- PILOT TRAINING**
Calligraphic/raster color display for simulation
p 231 A83-22832
- Target TV projector with dynamic raster shaping for use in dome simulators
p 231 A83-22834
- Pilot task profiles, human factors, and image realism
p 219 A83-22836
- PILOTS (PERSONNEL)**
Performance measures for aircraft carrier landings as a function of aircraft dynamics
[AD-A120473] p 206 N83-16334
- PITCHING MOMENTS**
Development of aerodynamic prediction methods for irregular planform wings
[NASA-CR-3664] p 195 N83-17515
- PLANAR STRUCTURES**
Curved lifting-line theory for thin planar wings
p 189 A83-21024

PLANFORMS

- Development of aerodynamic prediction methods for irregular planform wings
[NASA-CR-3664] p 195 N83-17515
- PLASTIC AIRCRAFT STRUCTURES**
A new high impact resin system for advanced composites with 300 F /150 C/ properties
p 222 A83-20429
- Plastic tooling for advanced composites
p 222 A83-20481
- The effect of loading rates, temperature and moisture on the fracture toughness of polycarbonate
p 223 A83-20497
- PLATE THEORY**
Finite element strength analysis of rotating shell-plate structures
p 229 A83-21448
- PLUTONIUM**
Sandia Aircraft Crashfire Facility
[DE82-004297] p 198 N83-16313
- POLLUTION TRANSPORT**
Gas turbine combustor modelling for calculating pollutant emission
p 212 A83-23142
- POLYCARBONATES**
The effect of loading rates, temperature and moisture on the fracture toughness of polycarbonate
p 223 A83-20497
- POPULATIONS**
Airport community soundproofing and relocation study
[PB82-259144] p 220 N83-16358
- POTENTIAL FLOW**
Aerosound from corner flow and flap flow
[AIAA PAPER 81-2039] p 237 A83-19813
- POTENTIAL THEORY**
Optimization of the supersonic drag of a smooth wing by use of linearized potential theory — French thesis
p 188 A83-20400
- POWDER METALLURGY**
The relationship between structure, properties and processing in powder metallurgy superalloys
p 224 A83-21493
- POWER EFFICIENCY**
Features of the selection of the basic parameters of cooled GTE turbines
p 211 A83-22655
- PREDICTION ANALYSIS TECHNIQUES**
Development of the basic methods needed to predict helicopters' aeroelastic behaviour
[ONERA, TP NO 1982-75] p 232 A83-23248
- Prediction of Aerodynamic Loads on Rotorcraft — helicopter and wind turbine rotors
[AGARD-CP-334] p 188 N83-17470
- Prediction and experimental verification of the velocity fields of a rotor during hovering
p 193 N83-17477
- Review of rotor loads prediction methods
p 194 N83-17484
- PREPREGS**
Plastic tooling for advanced composites
p 222 A83-20481
- PRESSURE DISTRIBUTION**
Wind tunnel force and pressure tests
[NASA-CR-3439] p 190 N83-16287
- Finite difference calculation of an inviscid transonic flow over oscillating airfoils
[RAE-TRANS-2087] p 191 N83-16292
- A study of the flow around a slotted flap end
[BU-279] p 192 N83-16306
- The aerodynamic performance of several flow control devices for internal flow systems
[NASA-TP-1972] p 221 N83-17560
- PRESSURE OSCILLATIONS**
Acoustic environment in large enclosures with a small opening exposed to flow
p 237 A83-22161
- PRESSURE SENSORS**
Slidestip indication system
p 210 N83-17466
- PRESSURE VESSELS**
Progress in the practical applications of fracture mechanics
p 230 A83-21796
- PRESSURIZED CABINS**
In-flight aircraft seat fire extinguishing tests (cabin hazard measurements)
[FAA-CT-82-111] p 197 N83-16308
- PRIMERS (COATINGS)**
The effect of primer-adhesive compatibility on adhesive peel strength at low temperature
p 222 A83-20448
- PROCESS CONTROL (INDUSTRY)**
A sensible approach to process control of adhesive bonding
p 185 A83-20432
- PRODUCT DEVELOPMENT**
Composite structural materials
[NASA-CR-169859] p 226 N83-17597
- PRODUCTION ENGINEERING**
Fabrication technology for aircraft engines — Russian book
p 185 A83-20381
- The relationship between structure, properties and processing in powder metallurgy superalloys
p 224 A83-21493

PROJECTORS

Target TV projector with dynamic raster shaping for use in dome simulators p 231 A83-22834

PROPELLANT ADDITIVES

An investigation of the effectiveness of smoke suppressant fuel additives for turbojet applications [AD-A121228] p 215 N83-17549

PROPELLER BLADES

Numerical calculations for performances of propellers in a static-state by vortex theory accounting of slipstream deformation and their comparisons with experiments p 189 A83-22072
 comparison of rotor analysis results with aerodynamic windtunnel data p 194 N83-17487
 An appraisal of rotor blade-tip vortex interaction and wake geometry from flight measurements p 194 N83-17488

PROPELLER SLIPSTREAMS

Numerical calculations for performances of propellers in a static-state by vortex theory accounting of slipstream deformation and their comparisons with experiments p 189 A83-22072

PROPELLERS

An analytical and experimental comparison of the flow field of an advanced swept turboprop [AIAA PAPER 83-0189] p 189 A83-21080

PROPULSION SYSTEM PERFORMANCE

Setting design goals for advanced propulsion systems [AIAA PAPER 81-1505] p 211 A83-22154

PROPULSION EFFICIENCY

The MCA method, a flight test technique to determine the thrust of jet aircraft in flight — Mass Consumption Acceleration p 202 A83-19661

PROTECTIVE COATINGS

The corrosion resistance of protective coatings p 223 A83-21454
 High temperature stability of pack aluminate coatings on IN38LC p 230 A83-21459
 Coating with overlay metallic-cermet alloy systems [NASA-CASE-LEW-13639-2] p 227 N83-17683

PSYCHOACOUSTICS

Multiple-event airplane noise annoyance [NASA-TP-2101] p 234 N83-16951
 A pilot study of human response to general aviation aircraft noise [NASA-CR-166053] p 238 N83-18404

PSYCHOLOGICAL EFFECTS

Multiple-event airplane noise annoyance [NASA-TP-2101] p 234 N83-16951

PULSE DOPPLER RADAR

F-16 pulse Doppler radar /AN/APG-66/ performance p 200 A83-22737

PUSHBROOM SENSOR MODES

Thermal infrared pushbroom imagery acquisition and processing — of NASA's Advanced Land Observing System p 209 A83-22841

PYLON MOUNTING

The minimization of pylon-mounted store effects on air combat capability [NASA-TM-84597] p 195 N83-17510

Q

QUALITY CONTROL

A sensible approach to process control of adhesive bonding p 185 A83-20432

R

RADAR BEACONS

Performance analysis of a dwell-time processor for monopulse beacon radars p 200 A83-22726
 Reply correlation test analysis in monopulse beacon radars p 200 A83-22727

RADAR CLUTTER MAPS

F-16 pulse Doppler radar /AN/APG-66/ performance p 200 A83-22737

RADAR CROSS SECTIONS

Laser and millimeter-wave backscatter of transmission cables p 199 A83-22523

RADAR DETECTION

Adaptive detection of targets in laser speckle noise p 208 A83-22521
 F-16 pulse Doppler radar /AN/APG-66/ performance p 200 A83-22737

RADAR NETWORKS

Real-time multiradar simulation with a multiprocessor p 200 A83-22824

RADAR TARGETS

Performance analysis of a dwell-time processor for monopulse beacon radars p 200 A83-22726
 Reply correlation test analysis in monopulse beacon radars p 200 A83-22727

F-16 pulse Doppler radar /AN/APG-66/ performance p 200 A83-22737

RADAR TRACKING

Real-time multiradar simulation with a multiprocessor p 200 A83-22824

Mode S baseline radar tracking [FAA-RD-82-53] p 233 N83-17770

RADIO NAVIGATION

Radio navigation and airplane navigation [AD-A120595] p 202 N83-16325

RADIOGRAPHY

Aircraft inspection using radiography p 185 A83-20478

RAMJET ENGINES

Investigation of slurry fuel performance for use in a ramjet propulsor p 223 A83-21014
 The effect of the nonuniformity of supersonic flow with shocks on friction and heat transfer in the channel of a hypersonic ramjet engine p 211 A83-22654
 On the choice of the optimal total wedge angle for the air intake of a hypersonic ramjet engine p 212 A83-22656
 Numerical calculation of the separation and connection of two-dimensional supersonic flows in channels with discontinuous boundaries p 212 A83-22658

RANDOM LOADS

An improved methodology for predicting random spectrum load interaction effects on fatigue crack growth p 224 A83-21802

REAL TIME OPERATION

United States Air Force tactical reconnaissance - An analysis and commentary p 186 A83-22574
 Advanced tactical air reconnaissance system p 186 A83-22575
 Real-time reconnaissance - A systems look at advanced technology p 200 A83-22576
 Real-time multiradar simulation with a multiprocessor p 200 A83-22824
 An on-board near-optimal climb-dash energy management [NASA-CR-169755] p 205 N83-16329

RECONNAISSANCE

United States Air Force tactical reconnaissance - An analysis and commentary p 186 A83-22574

RECTANGULAR WINGS

Embedded flow characteristics of sharp-edged rectangular wings p 190 A83-22152

REDUCED GRAVITY

Optical observations of unidirectional solidification in microgravity [NASA-TP-2110] p 225 N83-16492

REDUCED ORDER FILTERS

Suboptimal filters for INS alignment on a moving base p 199 A83-21019

REFUELING

Two years of training with the first true three-dimensional simulator p 218 A83-22833

REINFORCED SHELLS

A superelement analysis of stiffened shells — Russian book on aircraft fuselage structures p 202 A83-20392

REINFORCEMENT (STRUCTURES)

Program for establishing long-time flight service performance of composite materials in the center wing structure of C-130 aircraft. Phase 5 Flight service and inspection [NASA-CR-165770] p 227 N83-17600

RELIABILITY ENGINEERING

The software-implemented fault tolerance /SIFT/ approach to fault tolerant computing p 235 A83-22825

REMOTE SENSING

Remote sensing of problem birds in aviation p 196 A83-21876

REMOTE SENSORS

Stimulus variables affecting dynamic target acquisition p 209 A83-22590

REMOTELY PILOTED VEHICLES

Flight test results of an active flutter suppression system p 216 A83-22164
 Performance of high-altitude, long-endurance, turboprop airplanes using conventional or cryogenic fuels [NASA-TM-84534] p 207 N83-17530

RESEARCH

Composite structural materials [NASA-CR-169859] p 226 N83-17597

RESEARCH AND DEVELOPMENT

USAF ground fiber optic development program p 228 A83-19711
 Aeronautical research and technology policy Volume 1 Summary report p 187 N83-17452

RESEARCH MANAGEMENT

Activities report of the French aerospace and research industry p 221 N83-17564

RESEARCH VEHICLES

Flight test results of an active flutter suppression system p 216 A83-22164

RESIN MATRIX COMPOSITES

A new high impact resin system for advanced composites with 300 F /150 C/ properties p 222 A83-20429

RETROREFLECTORS

Evaluation of retroreflective pavement markers for precision and nonprecision runways [FAA-CT-82-112] p 220 N83-17558

REVERSED FLOW

Effect of broad properties fuel on injector performance in a reverse flow combustor [AIAA PAPER 83-0154] p 210 A83-21079

REYNOLDS NUMBER

The transonic wind tunnel Braunschweig of DFVLR p 217 A83-19663

RING STRUCTURES

Effects of noise radiated from convected ring sources in coaxial dual flow Part 1 The noise from unheated jets [NASA-CR-169737] p 238 N83-17238

ROBUSTNESS (MATHEMATICS)

Application of vector performance optimization to a robust control loop design for a fighter aircraft p 215 A83-21160

ROCKET ENGINES

Theory and design of flight-vehicle engines — Russian book p 211 A83-22651

ROCKET FLIGHT

Effective aerodynamic parameter evaluation from free flight tests p 203 A83-21005

ROLLER BEARINGS

Advances in high-speed rolling-element bearings — for aircraft engine and transmission application p 231 A83-22319

Bearing fatigue investigation 3 [NASA-CR-168029] p 233 N83-17880

ROTARY WING AIRCRAFT

Fixed wing and rotary wing flight testing of Navstar GPS as a civilian navigation system p 199 A83-19777

ROTARY WINGS

Damage tolerance and reparability of advanced composite structures p 222 A83-20484
 Prediction of the aerodynamic loads on helicopter blades in hovering and axial flight using lifting line theory p 189 A83-21016
 The aeroelastic behavior of curved helicopter blades in hovering and axial flight p 203 A83-21017
 A simplified model of the influence of elastic pitch variations on the rotor flapping dynamics p 204 A83-21025

Equivalent G/E of helicopter rotor blades — shear modulus to Young's modulus ratio p 230 A83-22151
 Rotor hovering performance using the method of fast free wake analysis p 190 A83-22162

A simulation model for the analysis of the dynamic behavior of a helicopter rotor under nonstationary limit flight conditions p 204 A83-23220
 Theoretical and experimental study of helicopter rotor noise [ONERA, TP NO 1982-74] p 205 A83-23247

Development of the basic methods needed to predict helicopters' aeroelastic behaviour [ONERA, TP NO 1982-75] p 232 A83-23248

Pre-design study for a modern 4-bladed rotor for the RSRA [NASA-CR-166155] p 206 N83-16331

Survey of active and passive means to reduce rotorcraft vibrations [MBB-UD-350] p 206 N83-16335

The role of analysis in the aerodynamic design of advanced rotors p 192 N83-17471

Calculation of 3D unsteady transonic flow around rotor blades p 193 N83-17474

Studies on blade-to-blade and rotor-fuselage-tail interferences p 193 N83-17479

Aeroelastic equilibrium of an helicopter rotor with nonlinear aerodynamic forces p 235 N83-17482

The development of a system for interdisciplinary analysis of rotorcraft flight characteristics p 236 N83-17485

Comparison of rotor analysis results with aerodynamic windtunnel data p 194 N83-17487

Transonic effects on helicopter rotor blades [MBB-349-81-O-E] p 195 N83-17520

Force initiations in helicopter rotor blades, wind channel fans and wind turbines [MBB-UD-356-82-O] p 196 N83-17522

An interactive system for transformation of known measures long internal surface of cylinders model for shafts [ISD-294] p 233 N83-17748

ROTATING SHAFTS

Nonlinear forced oscillations of a rotating shaft carrying an unsymmetrical rotor at the major critical speed p 228 A83-20288

ROTOR AERODYNAMICS

- Unbalance response analysis of a complete turbomachine p 228 A83-19674
- A simplified model of the influence of elastic pitch variations on the rotor flapping dynamics p 204 A83-21025
- Blade loading and rotation effects on compressor rotor wake near end walls p 190 A83-22138
- Rotor hovering performance using the method of fast free wake analysis p 190 A83-22162
- A simulation model for the analysis of the dynamic behavior of a helicopter rotor under nonstationary limit flight conditions p 204 A83-23220
- Theoretical and experimental study of helicopter rotor noise [ONERA, TP NO 1982-74] p 205 A83-23247
- Prediction of Aerodynamic Loads on Rotorcraft — helicopter and wind turbine rotors [AGARD-CP-334] p 188 A83-17470
- The role of analysis in the aerodynamic design of advanced rotors p 192 A83-17471
- Representation of airfoil behaviour p 192 A83-17472
- Studies of aerofoils and blade tips for helicopters p 193 A83-17473
- Studies on blade-to-blade and rotor-fuselage-tail interferences p 193 A83-17479
- Rotor-fuselage interference on engine internal aerodynamics in maneuvering high-speed rotorcraft p 193 A83-17480
- Development of the vortex ring wake model and its influence on the prediction of rotor loads p 194 A83-17481
- Review of rotor loads prediction methods p 194 A83-17484
- The development of a system for interdisciplinary analysis of rotorcraft flight characteristics p 236 A83-17485
- Methods used at Aerospatiale for calculating the loads on a rotor and experimental cross checks p 194 A83-17486
- ROTOR BLADES (TURBOMACHINERY)**
- Finite element strength analysis of rotating shell-plate structures p 229 A83-21448
- Blade loading and rotation effects on compressor rotor wake near end walls p 190 A83-22138
- Simplified free wake analysis for rotors [FFA-TN-1982-07] p 195 A83-17518
- Force initiations in helicopter rotor blades, wind channel fans and wind turbines [MBB-UD-356-82-O] p 196 A83-17522
- ROTOR BODY INTERACTIONS**
- Bo 105 rotor blade influence on the Calipso FLIR in the mast-mounted observation platform Ophelia p 205 A83-23249
- Rotor-fuselage interference on engine internal aerodynamics in maneuvering high-speed rotorcraft p 193 A83-17480
- ROTOR SPEED**
- Blade loading and rotation effects on compressor rotor wake near end walls p 190 A83-22138
- Prediction and experimental verification of the velocity fields of a rotor during hovering p 193 A83-17477
- ROTOR SYSTEMS RESEARCH AIRCRAFT**
- Predesign study for a modern 4-bladed rotor for the RSRA [NASA-CR-166155] p 206 A83-16331
- ROTORCRAFT AIRCRAFT**
- Dynamic stability of a buoyant quad-rotor aircraft p 216 A83-22160
- ROTORS**
- Nonlinear forced oscillations of a rotating shaft carrying an unsymmetrical rotor at the major critical speed p 228 A83-20288
- Studies on blade-to-blade and rotor-fuselage-tail interferences p 193 A83-17479
- Simplified free wake analysis for rotors [FFA-TN-1982-07] p 195 A83-17518
- Aerodynamic effect of a honeycomb rotor tip shroud on a 50.8-centimeter-tip-diameter core turbine [NASA-TP-2112] p 215 A83-17547
- ROUGHNESS**
- Prediction of pavement roughness [AD-A120009] p 232 A83-16566
- ROUTES**
- Conflict monitoring analysis of parallel opposite direction routes, volume 2 [AD-A120187] p 202 A83-16323
- RUNWAY LIGHTS**
- Maintenance of airport visual aid facilities Advisory circular [AC-150-5340-26] p 219 A83-16352
- Development of the precision approach path indicator light unit [RAE-TM-FS(B)-483] p 202 A83-17527

- Evaluation of retroreflective pavement markers for precision and nonprecision runways [FAA-CT-82-112] p 220 A83-17558
- RUNWAYS**
- Prediction of pavement roughness [AD-A120009] p 232 A83-16566
- Predicted and measured landing gear loads for the NF-5 aircraft taxiing over a bumpy runway [NLR-MP-82008-U] p 207 A83-17532

S**SAFETY**

- Desirable characteristics of underwater lights for helicopter escape hatches [AD-A120510] p 198 A83-16312

SANDS

- Compressor cascade performance deterioration caused by sand ingestion [NASA-CR-168067] p 190 A83-16286

SATELLITE NAVIGATION SYSTEMS

- Radio navigation and airplane navigation [AD-A120595] p 202 A83-16325

SATELLITE TRACKING

- A demonstration of relative positioning using conventional GPS Doppler receivers p 199 A83-19779

SCATTEROMETERS

- Program to compute the positions of the aircraft and of the aircraft sensor footprints [E83-10139] p 234 A83-16814

SCHEDULING

- Three computer based aids to maintenance scheduling [AD-A120351] p 187 A83-16280

SEALING

- Sputtered ceramic coatings and sealing layers [DE82-005225] p 226 A83-16531
- The JT8D and JT9D engine component improvement Performance improvement program [NASA-CR-167965] p 214 A83-17543

SEATS

- Studies on an acceleration platform and at the time of a simulated crash of helicopter antcrash seats p 197 A83-22976
- In-flight aircraft seat fire extinguishing tests (cabin hazard measurements) [FAA-CT-82-111] p 197 A83-16308
- Vertical impact tests of a modified F/FB-111 crew seat to evaluate headrest position and restraint configuration effects [AD-A120255] p 197 A83-16311

SEPARATED FLOW

- The calculation of separated flow at helicopter bodies [NASA-TM-76715] p 191 A83-16291
- Computation of the flow around wings with rear separation [DFVLR-FB-82-22] p 195 A83-17517

SERVICE LIFE

- Damage tolerance assessment of the A-7D aircraft structure p 204 A83-21771
- Equivalent damage A critical assessment [NASA-CR-167874] p 214 A83-17542
- Program for establishing long-time flight service performance of composite materials in the center wing structure of C-130 aircraft Phase 5 Flight service and inspection [NASA-CR-165770] p 227 A83-17600

SHARP LEADING EDGES

- Embedded flow characteristics of sharp-edged rectangular wings p 190 A83-22152

SHEAR FLOW

- A wind tunnel for unsteady turbulent shear flows - Design and flow calculation p 218 A83-19664

SHEAR PROPERTIES

- Equivalent G/E of helicopter rotor blades — shear modulus to Young's modulus ratio p 230 A83-22151

SHELL THEORY

- A superelement analysis of stiffened shells — Russian book on aircraft fuselage structures p 202 A83-20392
- Finite element strength analysis of rotating shell-plate structures p 229 A83-21448

SHOCK WAVES

- Finite difference calculation of an inviscid transonic flow over oscillating airfoils [RAE-TRANS-2087] p 191 A83-16292

SHORT HAUL AIRCRAFT

- Research and technology program perspectives for general aviation and commuter aircraft [NASA-CR-169875] p 187 A83-17454
- ATR 42 will have ultramodern, innovative cockpit, avionics p 208 A83-17759

SHORT TAKEOFF AIRCRAFT

- CTOL, STOAL, V/STOL - An operational comparison for forward deployed CVNs p 196 A83-22157

- The application of parameter estimation to flight measurements to obtain lateral-directional stability derivatives of an augmented jet-flap STOL airplane [NASA-TP-2033] p 216 A83-16350

- General purpose flight simulation program (FSPK-1) Part 1 Contents of the program [NAL-TR-702] p 207 A83-17529

- Criteria for handling qualities of military aircraft [AGARD-AR-186] p 217 A83-17555

SHROUDED TURBINES

- Aerodynamic effect of a honeycomb rotor tip shroud on a 50.8-centimeter-tip-diameter core turbine [NASA-TP-2112] p 215 A83-17547

SIDESLIP

- The wake of a sideslipping wing in low speed flow [VKI-TN-143] p 192 A83-16301
- Sideslip indication system p 210 A83-17466

SIGNAL PROCESSING

- High bypass ratio engine noise component separation by coherence technique p 211 A83-22159
- Adaptive detection of targets in laser speckle noise p 208 A83-22521

SIGNATURE ANALYSIS

- Stimulus variables affecting dynamic target acquisition p 209 A83-22590

SIKORSKY AIRCRAFT

- Optimal short-range trajectories for helicopters [NASA-TM-84303] p 187 A83-17451

SILICON NITRIDES

- Evaluation of air-cooled Si₃N₄ vanes p 224 A83-22263

SIMULATION

- Studies on an acceleration platform and at the time of a simulated crash of helicopter antcrash seats p 197 A83-22976

SIZE (DIMENSIONS)

- A method to estimate weight and dimensions of small aircraft propulsion gas turbine engines User's guide [NASA-CR-168049] p 213 A83-16343

SKIN (STRUCTURAL MEMBER)

- Demonstration of reparability and repair quality on graphite/epoxy structural subelements p 186 A83-20485

SLENDER WINGS

- Curved lifting-line theory for thin planar wings p 189 A83-21024

SLOTS

- A study of the flow around a slotted flap end [BU-279] p 192 A83-16306

SLURRY PROPELLANTS

- Investigation of slurry fuel performance for use in a ramjet propulsor p 223 A83-21014

SMOKE ABATEMENT

- An investigation of the effectiveness of smoke suppressant fuel additives for turbojet applications [AD-A121226] p 215 A83-17549

SNOW

- Obscuration by helicopter-produced snow clouds p 197 A83-22357

SOLAR COMPASSES

- Radio navigation and airplane navigation [AD-A120595] p 202 A83-16325

SOLIDIFICATION

- Optical observations of unidirectional solidification in microgravity [NASA-TP-2110] p 225 A83-16492

SOLIDS FLOW

- Compressor cascade performance deterioration caused by sand ingestion [NASA-CR-168067] p 190 A83-16286

SONIC BOOMS

- Supersonic maneuvers without superbooms p 189 A83-21021

SONIC NOZZLES

- Screach suppression in supersonic jets p 237 A83-19814

SOOT

- Sooting tendency of fuels containing polycyclic aromatics in a research combustor p 225 A83-23138

SOUND PROPAGATION

- Effects of noise radiated from convected ring sources in coaxial dual flow Part 1 The noise from unheated jets [NASA-CR-169737] p 238 A83-17238

SPARK MACHINING

- Electrical discharge machining of aluminum honeycomb core p 229 A83-20500

SPECIFICATIONS

- Technical and secretariat support of the MIL-STD-1515 fastener standardization effort [AD-A119828] p 232 A83-16760
- The A-7E software requirements document. Three years of change data [AD-A121602] p 237 A83-18322

SPECKLE PATTERNS

Adaptive detection of targets in laser speckle noise
p 208 A83-22521

SPOILERS

Wind tunnel force and pressure tests
[NASA-CR-3439] p 190 N83-16287

SPUTTERING

Sputtered ceramic coatings and sealing layers
[DE82-005225] p 226 N83-16531

STABILITY

Effect of external stores on the stability and control characteristics of a delta wing fighter model at Mach numbers from 0.60 to 2.01
[NASA-TM-84596] p 194 N83-17508

STABILITY DERIVATIVES

Investigation of the longitudinal motion of a flight vehicle by the method of the separation of motions
p 215 A83-20144

Representation of airfoil behaviour
p 192 N83-17472

STAINLESS STEELS

Rolling-element fatigue life of AMS 5900 balls
[NASA-TP-2080] p 232 N83-16758

STANDARDIZATION

Technical and secretariat support of the MIL-STD-1515 fastener standardization effort
[AD-A119828] p 232 N83-16760

STANDARDS

The development of standards for the common ICAO Data Interchange Network /CIDIN/ p 230 A83-22027

STATIC AERODYNAMIC CHARACTERISTICS

Numerical calculations for performances of propellers in a static-state by vortex theory accounting of slipstream deformation and their comparisons with experiments
p 189 A83-22072

STATIC LOADS

Methods used at Aerospatiale for calculating the loads on a rotor and experimental cross checks
p 194 N83-17486

STATIC PRESSURE

Flight evaluation of an engine static pressure noseprobe in an F-15 airplane
[NASA-CR-163109] p 214 N83-17546

STATIC STABILITY

Structural testing for static failure, flutter and other scary things
[NASA-TM-84606] p 234 N83-17899

STATIC TESTS

Theoretical stiffness matrix correction by using static test results
p 229 A83-21007

STATISTICAL CORRELATION

Reply correlation test analysis in monopulse beacon radars
p 200 A83-22727

STIFFNESS MATRIX

Theoretical stiffness matrix correction by using static test results
p 229 A83-21007

STRAIN RATE

The effect of loading rates, temperature and moisture on the fracture toughness of polycarbonate
p 223 A83-20497

STRATOSPHERE

Activities report of the French aerospace and research industry
p 221 N83-17564

STRESS ANALYSIS

Theoretical stiffness matrix correction by using static test results
p 229 A83-21007
Finite element strength analysis of rotating shell-plate structures
p 229 A83-21448
Damage tolerance assessment of the A-7D aircraft structure
p 204 A83-21771

STRESS INTENSITY FACTORS

Analysis and repair of flaws in thick structures
p 230 A83-21654

STRESS-STRAIN RELATIONSHIPS

Prediction of pavement roughness
[AD-A120009] p 232 N83-16566

STRINGERS

Initial design of stringer stiffened bend boxes using geometric programming
p 232 A83-23149

STRUCTURAL ANALYSIS

A superelement analysis of stiffened shells — Russian book on aircraft fuselage structures
p 202 A83-20392

STRUCTURAL DESIGN

Graphite/epoxy material characteristics and design techniques for airborne instrument application
p 225 A83-22595

Application of the matrix method of forces for the calculation of aircraft structures
p 232 A83-23221

STRUCTURAL DESIGN CRITERIA

Advanced composite elevator for Boeing 727 aircraft, volume 2
[NASA-CR-159258] p 205 N83-16330

STRUCTURAL ENGINEERING

Specific examples of aerospace applications of composites
p 227 N83-17621

STRUCTURAL MEMBERS

Specific examples of aerospace applications of composites
p 227 N83-17621

STRUCTURAL STABILITY

Development of the basic methods needed to predict helicopters' aeroelastic behaviour
[ONERA, TP NO 1982-75] p 232 A83-23248

STRUCTURAL STRAIN

The simulation of fatigue loads in aeronautics
p 219 A83-23241

STRUCTURAL VIBRATION

Theoretical stiffness matrix correction by using static test results
p 229 A83-21007

STRUCTURAL WEIGHT

A method to estimate weight and dimensions of small aircraft propulsion gas turbine engines User's guide
[NASA-CR-168049] p 213 N83-16343

STRUTS

Serviceability evaluation of advanced composite F-14A main-landing-gear-strut doors and overwing fairings
p 185 A83-20480

SUBMERGED BODIES

Desirable characteristics of underwater lights for helicopter escape hatches
[AD-A120331] p 197 N83-16310

SUBSONIC FLOW

Fuselage-lifting surfaces interaction in unsteady subsonic flow — French thesis
p 189 A83-22093

Computation of the flow around wings with rear separation
[DFVLR-FB-82-22] p 195 N83-17517

SUBSTRATES

Coating with overlay metallic-cermet alloy systems
[NASA-CASE-LEW-13639-2] p 227 N83-17683

SUPERSONIC AIRCRAFT

Design of an integrated control system for a supersonic aircraft power plant
p 212 A83-23175

SUPERSONIC COMBUSTION RAMJET ENGINES

Errors in the experimental determination of the parameters of supersonic combustion ramjet engines
p 211 A83-22653

The ideas of F. A. Tsander and an assessment of the application of jet engines for the acceleration of aerospace vehicles
p 221 A83-22657

SUPERSONIC CRUISE AIRCRAFT RESEARCH

Wind tunnel investigation of the transonic aerodynamic characteristics of forward swept wings — supersonic cruise aircraft research
p 190 A83-22153

SUPERSONIC DRAG

Optimization of the supersonic drag of a smooth wing by use of linearized potential theory — French thesis
p 188 A83-20400

SUPERSONIC FLIGHT

Supersonic maneuvers without superbooms
p 189 A83-21021

SUPERSONIC FLOW

Flutter of orthotropic panels in supersonic flow using affine transformations
p 228 A83-19821

The effect of the nonuniformity of supersonic flow with shocks on friction and heat transfer in the channel of a hypersonic ramjet engine
p 211 A83-22654

Numerical calculation of the separation and connection of two-dimensional supersonic flows in channels with discontinuous boundaries
p 212 A83-22658

SUPERSONIC FLUTTER

Flutter of orthotropic panels in supersonic flow using affine transformations
p 228 A83-19821

SUPERSONIC JET FLOW

Screech suppression in supersonic jets
p 237 A83-19814

SUPERSONIC SPEEDS

The minimization of pylon-mounted store effects on air combat capability
[NASA-TM-84597] p 195 N83-17510

SUPERSONIC WIND TUNNELS

Sound shield
[NASA-CASE-LAR-12883-1] p 237 N83-17235

SURFACE GEOMETRY

Curvature transitions of composite curves and surfaces
- Questions regarding details of computer-aided design — German thesis
p 235 A83-20398

SURFACE PROPERTIES

Prediction of pavement roughness
[AD-A120009] p 232 N83-16566

SURFACE ROUGHNESS

Compressor cascade performance deterioration caused by sand ingestion
[NASA-CR-168067] p 190 N83-16286

SURVEYS

Statistical summary Study to determine the IFR operational profile of the general aviation single pilot — instrument flight rules
[NASA-CR-165805] p 198 N83-17523

SWEEP FORWARD WINGS

Wind tunnel investigation of the transonic aerodynamic characteristics of forward swept wings — supersonic cruise aircraft research
p 190 A83-22153

SYSTEMS ENGINEERING

An optimal control approach to the design of moving flight simulators
p 218 A83-19949

Application of vector performance optimization to a robust control loop design for a fighter aircraft
p 215 A83-21160

The F29 flight test instrumentation and data processing system. An overview of requirements, design and organization
[NLR-MP-81035-U] p 209 N83-16340

SYSTEMS INTEGRATION

Design of an integrated control system for a supersonic aircraft power plant
p 212 A83-23175

T

TAIL ROTORS

Studies on blade-to-blade and rotor-fuselage-tail interferences — in helicopters
[MBB-351-82-O-E] p 195 N83-17521

TAIL SURFACES

Design, analyses, and model tests of an aeroelastically tailored lifting surface
p 204 A83-22155

TAKEOFF

Researchers study methods to combat effects of wind shear
p 196 A83-22175

TARGET ACQUISITION

Real-time reconnaissance - A systems look at advanced technology
p 200 A83-22576
Stimulus variables affecting dynamic target acquisition
p 209 A83-22590

TARGET RECOGNITION

Target TV projector with dynamic raster shaping for use in dome simulators
p 231 A83-22834

TAXIING

Predicted and measured landing gear loads for the NF-5 aircraft taxiing over a bumpy runway
[NLR-MP-82008-U] p 207 N83-17532

TECHNOLOGICAL FORECASTING

Reconnaissance of the year 2000 and beyond
p 186 A83-22577

DATAMAP and its impact on prediction programs
p 236 N83-17489

TECHNOLOGY ASSESSMENT

The development of advanced composite front fuselage technology
p 202 A83-20464

Will technology make the helicopter competitive
p 204 A83-21574

Multifunction CO2 laser radar technology
p 208 A83-22502

Real-time reconnaissance - A systems look at advanced technology
p 200 A83-22576

Future trends in the use of infrared line scanners for airborne reconnaissance
p 209 A83-22578

Composite structural materials
[NASA-CR-169859] p 226 N83-17597

TECHNOLOGY UTILIZATION

The use of helicopters in Europe Analysis and prospects
[MBB-UD-359/82-O] p 207 N83-17533

TELEVISION SYSTEMS

Target TV projector with dynamic raster shaping for use in dome simulators
p 231 A83-22834

TEMPERATURE CONTROL

Elevated temperature repairs of advanced composite structures
p 223 A83-20499

TEMPERATURE DEPENDENCE

The effect of loading rates, temperature and moisture on the fracture toughness of polycarbonate
p 223 A83-20497

TEMPERATURE MEASUREMENT

Cockpit temperatures and cooling requirements of a packed aircraft
[ARL-MECH-ENG-NOTE-388] p 205 N83-16327

TEMPERATURE PROFILES

Optical observations of unidirectional solidification in microgravity
[NASA-TP-2110] p 225 N83-16492

TERMINAL FACILITIES

The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations — (Los Angeles)
p 202 N83-17459

TERMINOLOGY

Distributed micro-processor applications to guidance and control systems
[AGARD-AR-178] p 236 N83-18295

TEST FACILITIES

The transonic wind tunnel Braunschweig of DFVLR
p 217 A83-19663

Compact installation for testing vectored-thrust engines
p 218 A83-22158

- Sandia Aircraft Crashfire Facility
[DE82-004297] p 198 N83-16313
- TEST STANDS**
A test stand for studying transient phenomena in aerodynamic turbomachine cascades p 218 A83-20913
- THERMAL CYCLING TESTS**
Metallurgical instabilities during the high temperature low cycle fatigue of nickel-base superalloys p 224 A83-22019
- THERMAL FATIGUE**
Metallurgical instabilities during the high temperature low cycle fatigue of nickel-base superalloys p 224 A83-22019
Sonic fatigue of advanced composite panels in thermal environments p 224 A83-22166
- THERMAL MAPPING**
Thermal infrared pushbroom imagery acquisition and processing — of NASA's Advanced Land Observing System p 209 A83-22841
Bo 105 rotor blade influence on the Calipso FLIR in the mast-mounted observation platform Ophelia p 205 A83-23249
- THERMAL STABILITY**
High temperature stability of pack aluminide coatings on IN38LC p 230 A83-21459
Graphite/epoxy material characteristics and design techniques for airborne instrument application p 225 A83-22595
Experimental study of the thermal stability of hydrocarbon fuels [NASA-CR-168027] p 228 A83-17728
- THERMOSETTING RESINS**
A new high impact resin system for advanced composites with 300 F /150 C/ properties p 222 A83-20429
- THIN WINGS**
Curved lifting-line theory for thin planar wings p 189 A83-21024
Embedded flow characteristics of sharp-edged rectangular wings p 190 A83-22152
- THIXOTROPY**
Investigation of slurry fuel performance for use in a ramjet propulsor p 223 A83-21014
- THREE DIMENSIONAL FLOW**
Unsteady transonic flow over wings including inviscid/viscous interaction p 190 A83-22132
Analysis of aero-optic interface phenomena p 190 A83-22588
A transonic quasi-3D analysis for gas turbine engines including split-flow capability for turbofans p 190 A83-22647
A study of optimum cowl shapes and flow port locations for minimum drag with effective engine cooling, volume 2 [NASA-CR-159380] p 191 N83-16289
A study of the flow around a slotted flap end [BU-279] p 192 N83-16306
Calculation of 3D unsteady transonic flow around rotor blades p 193 N83-17474
- THRESHOLDS**
Fatigue threshold and short crack significance for aircraft [NLR-MP-82007-U] p 234 N83-17902
- THROTTLING**
The aerodynamic performance of several flow control devices for internal flow systems [NASA-TP-1972] p 221 N83-17560
- THRUST AUGMENTATION**
Theory of resistance interference of airfoil wings and engine exhaust p 188 A83-19667
- THRUST MEASUREMENT**
The MCA method, a flight test technique to determine the thrust of jet aircraft in flight — Mass Consumption Acceleration p 202 A83-19661
- THRUST VECTOR CONTROL**
Aircraft maneuver mechanics with turning of the power-plant thrust vector p 216 A83-22076
Internal performance prediction for advanced exhaust systems — for tactical aircraft p 211 A83-22156
Compact installation for testing vectored-thrust engines p 218 A83-22158
A limited study of thrust vector control with guide vanes and jet rudder [FOA-C-20455-E3] p 221 N83-16386
- THUNDERSTORMS**
Observations of optical lightning emissions from above thunderstorms using U-2 aircraft p 234 A83-22703
- TILT ROTOR RESEARCH AIRCRAFT PROGRAM**
Dynamic structural aeroelastic stability testing of the XV-15 tilt rotor research aircraft [NASA-TM-84293] p 216 N83-16349
- TIP SPEED**
Velocity coupling A new concept for hover and axial flow wake analysis and design p 193 N83-17478
- TITANIUM OXIDES**
Effect of moisture on adhesively bonded titanium structures p 222 A83-20442
- TOLERANCES (MECHANICS)**
Damage tolerance and reparability of advanced composite structures p 222 A83-20484
Damage tolerance assessment of the A-7D aircraft structure p 204 A83-21771
- TOOLING**
Plastic tooling for advanced composites p 222 A83-20481
- TOWING**
Results from tests, with van-mounted sensor, of magnetic leader cable for aircraft guidance during roll-out and turnoff [NASA-TP-2092] p 209 N83-16338
Aircraft towing feasibility study p 207 N83-17458
- TRADEOFFS**
A practical economic criterion for fuel conservation p 239 N83-17468
- TRAINING AIRCRAFT**
NGT - The Next Generation Trainer p 203 A83-20599
- TRAINING SIMULATORS**
Calligraphic/raster color display for simulation p 231 A83-22832
Two years of training with the first true three-dimensional simulator p 218 A83-22833
Target TV projector with dynamic raster shaping for use in dome simulators p 231 A83-22834
Pilot task profiles, human factors, and image realism p 219 A83-22836
- TRAJECTORY ANALYSIS**
Effective aerodynamic parameter evaluation from free flight tests p 203 A83-21005
- TRAJECTORY MEASUREMENT**
Planning fuel-conservative descents with or without time constraints using a small programmable calculator Algorithm development and flight test results [NASA-TP-2085] p 210 N83-17535
- TRAJECTORY OPTIMIZATION**
Automation of on-board flightpath management p 215 A83-21002
- TRANSFORMATIONS (MATHEMATICS)**
Flutter of orthotropic panels in supersonic flow using affine transformations p 228 A83-19821
- TRANSIENT RESPONSE**
A test stand for studying transient phenomena in aerodynamic turbomachine cascades p 218 A83-20913
- TRANSMISSION LINES**
Laser and millimeter-wave backscatter of transmission cables p 199 A83-22523
- TRANSMISSION LOSS**
Theoretical and experimental evaluation of transmission loss of cylinders — as idealized aircraft fuselages p 237 A83-19808
- TRANSMISSIONS (MACHINE ELEMENTS)**
Advances in high-speed rolling-element bearings — for aircraft engine and transmission application p 231 A83-22319
- TRANSONIC FLOW**
Unsteady transonic flow over wings including inviscid/viscous interaction p 190 A83-22132
A transonic quasi-3D analysis for gas turbine engines including split-flow capability for turbofans p 190 A83-22647
Finite difference calculation of an inviscid transonic flow over oscillating airfoils [RAE-TRANS-2087] p 191 N83-16292
Calculation of 3D unsteady transonic flow around rotor blades p 193 N83-17474
Transonic effects on helicopter rotor blades [MBB-349-81-O-E] p 195 N83-17520
- TRANSONIC WIND TUNNELS**
The transonic wind tunnel Braunschweig of DFVLR p 217 A83-19663
Theoretical and experimental study of helicopter rotor noise [ONERA, TP NO 1982-74] p 205 A83-23247
- TRANSPORT AIRCRAFT**
Fuel for future transport aircraft p 222 A83-20082
Fuel conservation techniques in jet transport aircraft operations p 198 N83-17463
Computation of the flow around wings with rear separation [DFVLR-FB-82-22] p 195 N83-17517
Evaluation of laminar flow control systems for subsonic commercial transport aircraft. Executive summary [NASA-CR-159252] p 216 N83-17551
- TURBINE BLADES**
A test stand for studying transient phenomena in aerodynamic turbomachine cascades p 218 A83-20913
Automated machining of turbine blades by Rolls-Royce p 229 A83-21348
- The corrosion resistance of protective coatings p 223 A83-21454
High temperature stability of pack aluminide coatings on IN38LC p 230 A83-21459
Fatigue and creep considerations in the design of turbine components p 230 A83-21461
Analytical and experimental investigation of turbine blade damping [AD-A120470] p 213 N83-16345
Creep and fatigue interactions in a nickel base superalloy [NLR-MP-82003-U] p 234 N83-17903
- TURBINE ENGINES**
Blade erosion effects on aircraft-engine compressor performance [DE82-021791] p 213 N83-16346
Turbine engine fuel conservation by fan and compressor profile control p 213 N83-17467
Performance of high-altitude, long-endurance, turboprop airplanes using conventional or cryogenic fuels [NASA-TM-84534] p 207 N83-17530
- TURBINE EXHAUST NOZZLES**
The CF6 engine performance improvement [NASA-CR-165612] p 212 N83-16342
- TURBOCOMPRESSORS**
Cleaning gas turbine compressors - Some service experience with a wet-wash system p 210 A83-21350
Water injection into compressors of gas turbines for power increase and reduction of NOX emission [BMFT-FB-T-82-075] p 233 N83-16765
Study of advanced rotary combustion engines for commuter aircraft [NASA-CR-165399] p 214 N83-17545
- TURBOFAN ENGINES**
Eigensolutions for liners in uniform mean flow ducts p 237 A83-19810
PW 4000 - A radically new jet engine being developed in the USA p 212 A83-23239
Energy efficient engine Fan test hardware detailed design report [NASA-CR-165148] p 212 N83-16341
The CF6 engine performance improvement [NASA-CR-165612] p 212 N83-16342
Development of a procedure for calculating the effects of airfoil erosion on aircraft engine compressor performance p 213 N83-17457
Turbofan blade stresses induced by the flow distortion of a VTOL inlet at high angles of attack [NASA-TM-82963] p 194 N83-17509
Summary report for CF6 jet engine diagnostics program [NASA-CR-165582] p 214 N83-17539
An investigation of the effectiveness of smoke suppressant fuel additives for turbojet applications [AD-A121228] p 215 N83-17549
Aircraft turbofan noise [NASA-TM-83317] p 239 N83-18405
- TURBOGENERATORS**
Study of advanced rotary combustion engines for commuter aircraft [NASA-CR-165399] p 214 N83-17545
- TURBOJET ENGINES**
Improved fault detection in the hot section of turbojet engines by individual monitoring procedures p 210 A83-19666
An investigation of the effectiveness of smoke suppressant fuel additives for turbojet applications [AD-A121228] p 215 N83-17549
- TURBOMACHINE BLADES**
Turbofan blade stresses induced by the flow distortion of a VTOL inlet at high angles of attack [NASA-TM-82963] p 194 N83-17509
- TURBOMACHINERY**
Unbalance response analysis of a complete turbomachine p 228 A83-19674
Aerodynamic effect of a honeycomb rotor tip shroud on a 50.8-centimeter-tip-diameter core turbine [NASA-TP-2112] p 215 N83-17547
- TURBOPROP AIRCRAFT**
USAF Bioenvironmental Noise Data Handbook Volume 152 C-12A in-flight crew noise [AD-A120509] p 238 N83-17247
Performance of high-altitude, long-endurance, turboprop airplanes using conventional or cryogenic fuels [NASA-TM-84534] p 207 N83-17530
- TURBOPROP ENGINES**
An analytical and experimental comparison of the flow field of an advanced swept turboprop [AIAA PAPER 83-0189] p 189 A83-21080
- TURBULENT BOUNDARY LAYER**
Sound shield [NASA-CASE-LAR-12883-1] p 237 N83-17235
- TURBULENT FLOW**
A wind tunnel for unsteady turbulent shear flows - Design and flow calculation p 218 A83-19664

TURBULENT JETS

The estimation method on flutter boundary from subcritical random responses due to air turbulences
Problems of test procedures and data analysis
[NAL-TR-718] p 217 N83-17554

TURBULENT JETS

Screech suppression in supersonic jets
p 237 A83-19814

TURBULENT MIXING

Effects of envelope flames on drop gasification rates
in turbulent diffusion flames p 222 A83-19846

TURBULENT WAKES

Blade loading and rotation effects on compressor rotor
wake near end walls p 190 A83-22138

TWO DIMENSIONAL FLOW

Numerical calculation of the separation and connection
of two-dimensional supersonic flows in channels with
discontinuous boundaries p 212 A83-22658
Computation of the flow around wings with rear
separation
[DFVLR-FB-82-22] p 195 N83-17517

U

U-2 AIRCRAFT

Observations of optical lightning emissions from above
thunderstorms using U-2 aircraft p 234 A83-22703

UDIMET ALLOYS

Effects of cobalt in nickel-base superalloys
p 223 A83-21467

ULTRAVIOLET RADIATION

Advanced Ultra-Violet (UV) aircraft fire detection system
Volume 1 System description and flight test
[AD-A121253] p 198 N83-17526

UNIFORM FLOW

Eigenfunctions for liners in uniform mean flow ducts
p 237 A83-19810

UNSTEADY FLOW

Fuselage-lifting surfaces interaction in unsteady
subsonic flow --- French thesis p 189 A83-22093
Unsteady transonic flow over wings including
inviscid/viscous interaction p 190 A83-22132
Calculation of 3D unsteady transonic flow around rotor
blades p 193 N83-17474

Aircraft turbofan noise

[NASA-TM-83317] p 239 N83-18405

USER REQUIREMENTS

Operator influences on aircraft design
p 204 A83-21032

V

V/STOL AIRCRAFT

CTOL, STOAL, V/STOL - An operational comparison
for forward deployed CVNs p 196 A83-22157
Compact installation for testing vectored-thrust
engines p 218 A83-22158
Sonic fatigue of advanced composite panels in thermal
environments p 224 A83-22166

VANES

Evaluation of air-cooled Si3N4 vanes
p 224 A83-22263
Erosion of protective compressor coatings
[NLR-MP-87067-U] p 228 N83-17716

VAPOR DEPOSITION

The corrosion resistance of protective coatings
p 223 A83-21454

VAPOR PRESSURE

A rapid method for determining the initial boiling point
and the saturated-vapor pressure of petroleum products
--- jet fuel tests in railroad tank cars p 229 A83-20962

VARIABLE MASS SYSTEMS

General basic concepts for a trajectory simulation of a
guided missile
[PML-1981-36] p 221 N83-17574

VELOCITY COUPLING

Velocity coupling. A new concept for hover and axial
flow wake analysis and design p 193 N83-17478

VELOCITY DISTRIBUTION

Prediction and experimental verification of the velocity
fields of a rotor during hovering p 193 N83-17477

VERTICAL TAKEOFF AIRCRAFT

Aircraft maneuver mechanics with turning of the
power-plant thrust vector p 216 A83-22076
Criteria for handling qualities of military aircraft
[AGARD-AR-186] p 217 N83-17555

VIBRATION DAMPING

Flight test results of an active flutter suppression
system p 216 A83-22164
Survey of active and passive means to reduce rotorcraft
vibrations
[MBB-UD-350] p 206 N83-16335
Vibration-free internal combustion engine for general
aviation
[BMFT-FB-W-82-016] p 213 N83-16347

VIBRATION ISOLATORS

Survey of active and passive means to reduce rotorcraft
vibrations
[MBB-UD-350] p 206 N83-16335

VIBRATIONAL STRESS

Turbofan blade stresses induced by the flow distortion
of a VTOL inlet at high angles of attack
[NASA-TM-82963] p 194 N83-17509

VISCOMETRY

Viscometric and misting properties of polymer-modified
fuel
[NASA-CR-169750] p 226 N83-16543

VISCOUS FLOW

A study of optimum cowl shapes and flow port locations
for minimum drag with effective engine cooling, volume
2
[NASA-CR-159380] p 191 N83-16289

VISIBILITY

Aircraft accident report. Sun West Airlines Flight 104,
Piper PA-31-350(T-1020), N41070, Durango-LaPlata
County Airport, Durango, Colorado, December 31, 1981
[PB82-910413] p 197 N83-16309
Desirable characteristics of underwater lights for
helicopter escape hatches
[AD-A120510] p 198 N83-16312

VISUAL AIDS

Development of the precision approach path indicator
light unit
[RAE-TM-FS(B)-483] p 202 N83-17527
Evaluation of retroreflective pavement markers for
precision and nonprecision runways
[FAA-CT-82-112] p 220 N83-17558
Evaluation of supplemental lights for caution bars
[FAA-CT-82-119] p 220 N83-17559

VISUAL TASKS

Pilot task profiles, human factors, and image realism
p 219 A83-22836

VORTEX ALLEVIATION

Development of the vortex ring wake model and its
influence on the prediction of rotor loads
p 194 N83-17481
An appraisal of rotor blade-tip vortex interaction and
wake geometry from flight measurements
p 194 N83-17488

VORTEX BREAKDOWN

Laser-Doppler velocimeter (LDV) measurements of the
velocity field of a leading edge vortex over a delta wing
before and after vortex breakdown
[VKI-TN-142] p 192 N83-16300

VORTEX RINGS

Development of the vortex ring wake model and its
influence on the prediction of rotor loads
p 194 N83-17481

VORTICES

Aerosound from corner flow and flap flow
[AIAA PAPER 81-2039] p 237 A83-19813
Numerical calculations for performances of propellers
in a static-state by vortex theory accounting of slipstream
deformation and their comparisons with experiments
p 189 A83-22072
Rotor hovering performance using the method of fast
free wake analysis p 190 A83-22162
Subsonic steady and unsteady aerodynamic loads on
missiles and aircraft
[NASA-CR-169749] p 190 N83-16284
Laser-Doppler velocimeter (LDV) measurements of the
velocity field of a leading edge vortex over a delta wing
before and after vortex breakdown
[VKI-TN-142] p 192 N83-16300
An appraisal of rotor blade-tip vortex interaction and
wake geometry from flight measurements
p 194 N83-17488
Simplified free wake analysis for rotors
[FFA-TN-1982-07] p 195 N83-17518

VORTICITY

Computer-enhanced analysis of a jet in a cross
stream p 228 A83-19804

W

WAKES

The calculation of separated flow at helicopter bodies
[NASA-TM-76715] p 191 N83-16291
The wake of a sideslipping wing in low speed flow
[VKI-TN-143] p 192 N83-16301

WALL FLOW

The transonic wind tunnel Braunschweig of DFVLR
p 217 A83-19663
Blade loading and rotation effects on compressor rotor
wake near end walls p 190 A83-22138

WARFARE

Future trends in the use of infrared line scanners for
airborne reconnaissance p 209 A83-22578

WARNING SYSTEMS

Advanced Ultra-Violet (UV) aircraft fire detection system
Volume 1 System description and flight test
[AD-A121253] p 198 N83-17526

WASHING

Cleaning gas turbine compressors - Some service
experience with a wet-wash system p 210 A83-21350

WASTES

Air traffic control Its effect on fuel conservation
p 202 N83-17464

WATER

Optical observations of unidirectional solidification in
microgravity
[NASA-TP-2110] p 225 N83-16492

WATER INJECTION

Water injection into compressors of gas turbines for
power increase and reduction of NOX emission
[BMFT-FB-T-82-075] p 233 N83-16765

WAVE PROPAGATION

Radiation from a double layer jet --- aerodynamic
noise p 237 A83-20364

WAVELENGTH DIVISION MULTIPLEXING

Fiber optic wavelength multiplexing for civil aviation
applications p 208 A83-22492

WEAPON SYSTEMS

Lasers in aviation --- Russian book
p 229 A83-20384
Thirty years of fighter armament p 203 A83-20600
Setting design goals for advanced
propulsion systems
[AIAA PAPER 81-1505] p 211 A83-22154

WEAPONS DELIVERY

B-52 roles in sea control p 186 A83-20646

WIND PROFILES

A practical economic criterion for fuel conservation
p 239 N83-17468

WIND SHEAR

Researchers study methods to combat effects of wind
shear p 196 A83-22175

Anti-misting additives for jet fuels

[NASA-CR-169751] p 225 N83-16417

WIND TUNNEL APPARATUS

A wind tunnel for unsteady turbulent shear flows - Design
and flow calculation p 218 A83-19664
Force initiations in helicopter rotor blades, wind channel
fans and wind turbines
[MBB-UD-356-82-O] p 196 N83-17522

WIND TUNNEL MODELS

The half-model technique in the wind tunnel and its
employment in the development of the airbus family
[NASA-TM-76970] p 205 N83-16328

WIND TUNNEL TESTS

Wind tunnel investigation of the transonic aerodynamic
characteristics of forward swept wings --- supersonic cruise
aircraft research p 190 A83-22153
Wind tunnel force and pressure tests
[NASA-CR-3439] p 190 N83-16287
Low-speed aerodynamic characteristics of a
17-percent-thick medium speed airfoil designed for general
aviation applications
[NASA-TP-1786] p 191 N83-16290

WIND TUNNEL WALLS

Sound shield
[NASA-CASE-LAR-12883-1] p 237 N83-17235

WIND TUNNELS

Comparison of rotor analysis results with aerodynamic
windtunnel data p 194 N83-17487
The aerodynamic performance of several flow control
devices for internal flow systems
[NASA-TP-1972] p 221 N83-17560

WIND TURBINES

Prediction of Aerodynamic Loads on Rotorcraft ---
helicopter and wind turbine rotors
[AGARD-CP-334] p 188 N83-17470
Force initiations in helicopter rotor blades, wind channel
fans and wind turbines
[MBB-UD-356-82-O] p 196 N83-17522

WIND VELOCITY

Computer-enhanced analysis of a jet in a cross
stream p 228 A83-19804

WINDOWS (APERTURES)

Service operation of a CFRP window frame in short fiber
pressing
[BMFT-FB-W-82-021] p 233 N83-17749

WING FLAPS

Aerosound from corner flow and flap flow
[AIAA PAPER 81-2039] p 237 A83-19813
A study of the flow around a slotted flap end
[BU-279] p 192 N83-16306

WING LOADING

Design, analyses, and model tests of an aeroelastically
tailored lifting surface p 204 A83-22155
The simulation of fatigue loads in aeronautics
p 219 A83-23241

WING NACELLE CONFIGURATIONS

Theory of resistance interference of airfoil wings and
engine exhaust p 188 A83-19667

WING OSCILLATIONS

Flight test results of an active flutter suppression system p 216 A83-22164

WING PANELS

Initial design of stringer stiffened bend boxes using geometric programming p 232 A83-23149

WING PLANFORMS

Unsteady transonic flow over wings including inviscid/viscous interaction p 190 A83-22132

WING PROFILES

Optimization of the supersonic drag of a smooth wing by use of linearized potential theory --- French thesis p 188 A83-20400

Fuselage-lifting surfaces interaction in unsteady subsonic flow --- French thesis p 189 A83-22093

WING ROOTS

Eigenspace techniques for active flutter suppression [NASA-CR-169858] p 217 N83-17556

WING TIP VORTICES

Theoretical and experimental study of helicopter rotor noise [ONERA, TP NO 1982-74] p 205 A83-23247

WINGS

Primary bonded aircraft wing construction p 186 A83-20493

Design considerations for the construction of a Shenff wing in composite materials [BU-280] p 206 N83-16337

Computation of the flow around wings with rear separation [DFVLR-FB-82-22] p 195 N83-17517

Program for establishing long-time flight service performance of composite materials in the center wing structure of C-130 aircraft. Phase 5 Flight service and inspection [NASA-CR-165770] p 227 N83-17600

X

X RAY INSPECTION

Aircraft inspection using radiography p 185 A83-20478

XV-15 AIRCRAFT

Dynamic structural aeroelastic stability testing of the XV-15 tilt rotor research aircraft [NASA-TM-84293] p 216 N83-16349

Y

YAK 40 AIRCRAFT

Electrical, avionic, and sensor equipment of the Yak-40 aircraft /2nd revised and enlarged edition/ --- Russian book p 208 A83-20390

YAWING MOMENTS

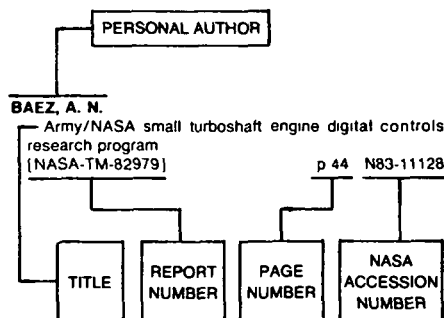
Helicopter fin effectiveness [BU-271] p 206 N83-16336

YIELD POINT

Damage tolerance and reparability of advanced composite structures p 222 A83-20484

Fatigue threshold and short crack significance for aircraft [NLR-MP-82007-U] p 234 N83-17902

Typical Personal Author Index Listing



Listings in this index are arranged alphabetically by personal author. The title of the document provides the user with a brief description of the subject matter. The report number helps to indicate the type of document listed (e.g., NASA report, translation, NASA contractor report). The page and accession numbers are located beneath and to the right of the title. Under any one author's name the accession numbers are arranged in sequence with the AIAA accession numbers appearing first.

A

- ABBINK, F. J.**
Computers in avionics systems
[NLR-MP-81063-U] p 236 N83-18291
- AKIMOV, V. M.**
Current problems in the testing of aircraft engines p 211 A83-22652
- AKSENOV, O. M.**
A superelement analysis of stiffened shells p 202 A83-20392
- AL-KHATIB, H. H.**
Laser and millimeter-wave backscatter of transmission cables p 199 A83-22523
- ALKEZWEENY, A. J.**
Composite design of an advanced airborne monitoring system
[DE82-006980] p 235 N83-18106
- ALLIER, N.**
Evaluation of lubricants for air compressors
[PB82-259003] p 226 N83-16538
- ANDERS, K.**
Laser-Doppler velocimeter (LDV) measurements of the velocity field of a leading edge vortex over a delta wing before and after vortex breakdown
[VKI-TN-142] p 192 N83-16300
- ANDERSON, S. B.**
The influence of handling qualities, crashworthiness and other engineering factors on aircraft safety p 198 N83-17493
The engineering investigation of aircraft accidents p 198 N83-17497
- ANDO, Y.**
The estimation method on flutter boundary from subcritical random responses due to air turbulences
Problems of test procedures and data analysis
[NAL-TR-718] p 217 N83-17554
- ANDRADA, T.**
Thermal infrared pushbroom imagery acquisition and processing p 209 A83-22841
- ANNUSHKIN, I. U. M.**
The ideas of F. A. Tsander and an assessment of the application of jet engines for the acceleration of aerospace vehicles p 221 A83-22657

- ANSELL, G. S.**
Composite structural materials
[NASA-CR-169859] p 226 N83-17597
- ANTOLOVICH, S. D.**
Metallurgical instabilities during the high temperature low cycle fatigue of nickel-base superalloys p 224 A83-22019
- ARCIDIACONO, P. J.**
Review of rotor loads prediction methods p 194 N83-17484
- ARNOLD, D. B.**
Service history of phosphoric acid anodized aluminum structure p 185 A83-20479
- ASHENBERG, J.**
Curved lifting-line theory for thin planar wings p 189 A83-21024
- AUBIN, C.**
The relationship between structure, properties and processing in powder metallurgy superalloys p 224 A83-21493

B

- BAIR, M.**
Spatial calibration of a multispectral data base p 209 A83-22882
- BAIR, W. G.**
Coal gasification for stationary gas-turbine applications
[DE82-902135] p 226 N83-16553
- BAKER, L. H.**
Mode S baseline radar tracking
[FAA-RD-82-53] p 233 N83-17770
- BALAN, C.**
Compressor cascade performance deterioration caused by sand ingestion
[NASA-CR-168067] p 190 N83-16286
- BAMBERGER, E. N.**
Bearing fatigue investigation 3
[NASA-CR-168029] p 233 N83-17880
- BANDO, T.**
General purpose flight simulation program (FSPK-1)
Part 1 Contents of the program
[NAL-TR-702] p 207 N83-17529
- BAR-ITZHACK, I. Y.**
Suboptimal filters for INS alignment on a moving base p 199 A83-21019
- BARKER, W. R.**
Prediction of pavement roughness
[AD-A120009] p 232 N83-16566
- BARNWAL, R. P.**
Management of bird problem in Indian airlines p 196 A83-21877
- BARTEL, H.**
Acoustic environment in large enclosures with a small opening exposed to flow p 237 A83-22181
- BARTHOLOMEW, P.**
Initial design of stringer stiffened bend boxes using geometric programming p 232 A83-23149
- BARTON, C. K.**
Computer program to predict noise of general aviation aircraft. User's guide
[NASA-CR-168050] p 238 N83-17242
- BATTERSON, J. G.**
Analysis of oscillatory motion of a light airplane at high values of lift coefficient
[NASA-TM-84563] p 216 N83-17550
- BAUCHSPIES, J. S.**
Research and technology program perspectives for general aviation and commuter aircraft
[NASA-CR-169875] p 187 N83-17454
- BAUMBICK, R. J.**
Fiber optics for aircraft engine/inlet control p 211 A83-22494
- BEARD, J.**
Spatial calibration of a multispectral data base p 209 A83-22882
- BEASELEY, W. D.**
Low-speed aerodynamic characteristics of a 17-percent-thick medium speed airfoil designed for general aviation applications
[NASA-TP-1786] p 191 N83-16290
- BECHERER, R. J.**
Adaptive detection of targets in laser speckle noise p 208 A83-22521
- BECKWITH, I. E.**
Sound shield
[NASA-CASE-LAR-12883-1] p 237 N83-17235
- BEDDOES, T. S.**
Representation of airfoil behaviour p 192 N83-17472
- BEIDEMAN, L. R.**
Stimulus variables affecting dynamic target acquisition p 209 A83-22590
- BEIGELMAN, Z.**
A simplified model of the influence of elastic pitch variations on the rotor flapping dynamics p 204 A83-21025
- BENEPE, D. B., SR.**
Development of aerodynamic prediction methods for irregular planform wings
[NASA-CR-3664] p 195 N83-17515
- BERKOWITZ, L. F.**
Velocity coupling. A new concept for hover and axial flow wake analysis and design p 193 N83-17478
- BERKOWITZ, M.**
Study of advanced rotary combustion engines for commuter aircraft
[NASA-CR-165399] p 214 N83-17545
- BERLIAND, A. T.**
Numerical calculation of the separation and connection of two-dimensional supersonic flows in channels with discontinuous boundaries p 212 A83-22658
- BERTKE, R. S.**
Materials screening tests of the FOD impact design technology program, task 4C
[AD-A119839] p 225 N83-16401
- BEZAMAT, G.**
Studies on an acceleration platform and at the time of a simulated crash of helicopter anticrash seats p 197 A83-22976
- BIRKENHEUER, N. J.**
Computer-enhanced analysis of a jet in a cross stream p 228 A83-19804
- BLOZY, J. T.**
Internal performance prediction for advanced exhaust systems p 211 A83-22156
- BLUME, L. R.**
A study of real-time computer graphic display technology for aeronautical applications
[NASA-CR-169828] p 236 N83-18307
- BOBER, L. J.**
An analytical and experimental comparison of the flow field of an advanced swept turboprop
[AIAA PAPER 83-0189] p 189 A83-21080
- BOBICK, J. C.**
Oceanic Area System Improvement Study (OASIS)
Volume 7 North Atlantic region flight cost model results
[FAA-EM-81-17-VOL-7] p 201 N83-16319
- BOEHM, H.-D. V.**
Bo 105 rotor blade influence on the Calipso FLIR in the mast-mounted observation platform Ophelia p 205 A83-23249
- BOELKOW, L.**
The use of helicopters in Europe. Analysis and prospects
[MBB-UD-359/82-O] p 207 N83-17533
- BONDARCHUK, I. E.**
Electrical, avionics, and sensor equipment of the Yak-40 aircraft /2nd revised and enlarged edition/ p 208 A83-20390
- BORGER, J. G.**
Operator influences on aircraft design p 204 A83-21032
- BORLAND, C. J.**
Unsteady transonic flow over wings including inviscid/viscous interaction p 190 A83-22132
- BORZOV, V. I.**
Investigation of the longitudinal motion of a flight vehicle by the method of the separation of motions p 215 A83-20144
- BOUSLEY, R. F.**
Microprocessor applications to guidance and control architectures p 236 N83-18297

BOWLES, R. L.

The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations p 202 N83-17459

BOYTOS, J. F.

Compact installation for testing vectored-thrust engines p 218 A83-22158

BRAMER, J. R.

An investigation of the effectiveness of smoke suppressant fuel additives for turbojet applications [AD-A121228] p 215 N83-17549

BRAYMEN, W. W.

Design, analyses, and model tests of an aeroelastically tailored lifting surface p 204 A83-22155

BREEN, K. R.

Effect of moisture on adhesively bonded titanium structures p 222 A83-20442

BREWER, G. D.

Fuel for future transport aircraft p 222 A83-20082

BRINKLEY, J. W.

Vertical impact tests of a modified F/FB-111 crew seat to evaluate headrest position and restraint configuration effects [AD-A120255] p 197 N83-16311

BRITTAIN, D.

Cleaning gas turbine compressors - Some service experience with a wet-wash system p 210 A83-21350

BROOK, M.

Observations of optical lightning emissions from above thunderstorms using U-2 aircraft p 234 A83-22703

BROOKS, R. B.

Applications of simulator freeze to carrier glideslope tracking instruction [AD-A118862] p 220 N83-16356

BROSSELIN, S.

ATR 42 will have ultramodern, innovative cockpit, avionics p 208 N83-17759

BROTHERHOOD, P.

An appraisal of rotor blade-tip vortex interaction and wake geometry from flight measurements p 194 N83-17488

BROWN, G. S.

Evaluation of retroreflective pavement markers for precision and nonprecision runways [FAA-CT-82-112] p 220 N83-17558

BROWN, R.

A pilot study of human response to general aviation aircraft noise [NASA-CR-166053] p 238 N83-18404

BROWN, T. J.

Thermal infrared pushbroom imagery acquisition and processing p 209 A83-22841

BUNDICK, W. T.

Results from tests, with van-mounted sensor, of magnetic leader cable for aircraft guidance during roll-out and turnoff [NASA-TP-2092] p 209 N83-16338

BURMAN, G.

Fatigue failure under fretting conditions p 224 A83-21481

BURMAN, Z. I.

A superelement analysis of stiffened shells p 202 A83-20392

BUSINESS, K. M.

Composite design of an advanced airborne monitoring system [DE82-006980] p 235 N83-18106

C**CALLINAN, R. J.**

Analysis and repair of flaws in thick structures p 230 A83-21654

CAPLOT, M.

Theoretical and experimental study of helicopter rotor noise [ONERA, TP NO. 1982-74] p 205 A83-23247

CARAVASOS, N.

Damage tolerance and reparability of advanced composite structures p 222 A83-20484

CARMER, D.

Spatial calibration of a multispectral data base p 209 A83-22882

CARRILLO, G.

A sensible approach to process control of adhesive bonding p 185 A83-20432

CARTER, C. S.

Service history of phosphoric acid anodized aluminum structure p 185 A83-20479

CATON, W. M.

Fiber optics for electro-magnetic pulse /EMP/ simulators p 218 A83-22495

CERIOTTI, A.

First results for the definition of a general rotorcraft dynamic program p 236 N83-17483

CHAI, R.

Airport community soundproofing and relocation study [PB82-259144] p 220 N83-16358

CHALK, C. R.

In-flight investigation of large airplane flying qualities for approach and landing [AD-A120202] p 206 N83-16332

CHANG, J. B.

An improved methodology for predicting random spectrum load interaction effects on fatigue crack growth p 224 A83-21802

CHANG, L.-K.

An analytical and experimental comparison of the flow field of an advanced swept turboprop [AIAA PAPER 83-0189] p 189 A83-21080

CHAPMAN, G. C.

Statistical summary Study to determine the IFR operational profile of the general aviation single pilot [NASA-CR-165805] p 198 N83-17523

CHEVAGIN, A. F.

Numerical calculation of the separation and connection of two-dimensional supersonic flows in channels with discontinuous boundaries p 212 A83-22658

CHMURA, L. J.

The A-7E software requirements document Three years of change data [AD-A121602] p 237 N83-18322

CHOVIL, D. V.

Advanced composite elevator for Boeing 727 aircraft, volume 2 [NASA-CR-159258] p 205 N83-16330

CHRISTIAN, H. J.

Observations of optical lightning emissions from above thunderstorms using U-2 aircraft p 234 A83-22703

CHUNG, J. C.

Constrained eigenvalue/eigenvector assignment - Application to flight control systems p 215 A83-21006

CLIFF, E. M.

An on-board near-optimal climb-dash energy management [NASA-CR-169755] p 205 N83-16329

COLKET, M. B.

Experimental study of the thermal stability of hydrocarbon fuels [NASA-CR-168027] p 228 N83-17728

CONDOM, P.

Will technology make the helicopter competitive p 204 A83-21574

CONNELLY, E. M.

Performance measures for aircraft carrier landings as a function of aircraft dynamics [AD-A120473] p 206 N83-16334

CONNOR, J. T.

Fixed wing and rotary wing flight testing of Navstar GPS as a civilian navigation system p 199 A83-19777

CONRAD, B.

Oceanic Area System Improvement Study (OASIS) Volume 1 Executive summary and improvement alternatives development and analysis [FAA-EM-81-17-VOL-1] p 200 N83-16314
Oceanic Area System Improvement Study (OASIS) Volume 5 North Atlantic, Central East Pacific, and Caribbean regions communication systems description [FAA-EM-81-17-VOL-5] p 201 N83-16318

COOK, T. S.

Equivalent damage A critical assessment [NASA-CR-167874] p 214 N83-17542

COOPER, S. P.

High temperature stability of pack aluminate coatings on IN38LC p 230 A83-21459

CORBETT, F. J.

Thermal infrared pushbroom imagery acquisition and processing p 209 A83-22841

CORTEN, H. T.

Progress in the practical applications of fracture mechanics p 230 A83-21796

COSTES, J. J.

Aeroelastic equilibrium of an helicopter rotor with nonlinear aerodynamic forces p 235 N83-17482

COULURIS, G. J.

Oceanic Area System Improvement Study (OASIS) Volume 1 Executive summary and improvement alternatives development and analysis [FAA-EM-81-17-VOL-1] p 200 N83-16314
Oceanic Area System Improvement Study (OASIS) Volume 2 North Atlantic region air traffic services system description [FAA-EM-81-17-VOL-2] p 201 N83-16315
Oceanic Area System Improvement Study (OASIS) Volume 3 Central East Pacific region air traffic services system description [FAA-EM-81-17-VOL-3] p 201 N83-16316
Oceanic Area System Improvement Study (OASIS) Volume 4 Caribbean region air traffic services system description [FAA-EM-81-17-VOL-4] p 201 N83-16317

Oceanic Area System Improvement Study (OASIS) Volume 7 North Atlantic region flight cost model results [FAA-EM-81-17-VOL-7] p 201 N83-16319
Oceanic Area System Improvement Study (OASIS) Volume 8 Central East Pacific region flight cost model results [FAA-EM-81-17-VOL-8] p 201 N83-16320

COVEY, R. R.

Potential fuel savings through improved airframe maintenance p 188 N83-17456

CRAVEN, H. H., JR.

Fuel conservation techniques in jet transport aircraft operations p 198 N83-17463

CREEL, T. R., JR.

Sound shield [NASA-CASE-LAR-12883-1] p 237 N83-17235

CROCKER, M. J.

Theoretical and experimental evaluation of transmission loss of cylinders p 237 A83-19808

CUNNINGHAM, W. H.

Compact installation for testing vectored-thrust engines p 218 A83-22158

D**DADONE, L.**

The role of analysis in the aerodynamic design of advanced rotors p 192 N83-17471

DALLE MESE, E.

Performance analysis of a dwell-time processor for monopulse beacon radars p 200 A83-22726
Reply correlation test analysis in monopulse beacon radars p 200 A83-22727

DASH, R.

Radiation from a double layer jet p 237 A83-20364
Effects of flight on noise radiated from convected ring sources in coaxial dual flow Part 2 The noise from heated jets p 238 N83-17237
Effects of noise radiated from convected ring sources in coaxial dual flow Part 1 The noise from unheated jets [NASA-CR-169737] p 238 N83-17238

DAT, R.

Development of the basic methods needed to predict helicopters' aeroelastic behaviour [ONERA, TP NO 1982-75] p 232 A83-23248

DAVIDSON, J. H.

The relationship between structure, properties and processing in powder metallurgy superalloys p 224 A83-21493

DAVIDSON, R. G.

Aging and performance of structural film adhesives 1 - A comparison of two high-temperature curing, epoxy-based systems p 223 A83-21048

DAVIS, S. J.

Predesign study for a modern 4-bladed rotor for the RSRA [NASA-CR-166155] p 206 N83-16331

DEEL, O. L.

Technical and secretariat support of the MIL-STD-1515 fastener standardization effort [AD-A119828] p 232 N83-16760

DEL BOCA, R. L.

Multifunction CO2 laser radar technology p 208 A83-22502

DESPO, D. A.

Oceanic Area System Improvement Study (OASIS) Volume 9 Flight cost model description [FAA-EM-81-17-VOL-9] p 201 N83-16321

DESPER, O. E.

Advanced composite elevator for Boeing 727 aircraft, volume 2 [NASA-CR-159258] p 205 N83-16330

DEVILLER, D.

The simulation of fatigue loads in aeronautics p 219 A83-23241

DEZHIN, V. N.

Lasers in aviation p 229 A83-20384

DIEDRICH, J. H.

Turbobfan blade stresses induced by the flow distortion of a VTOL inlet at high angles of attack [NASA-TM-82963] p 194 N83-17509

DINI, D.

Rotor-fuselage interference on engine internal aerodynamics in maneuvering high-speed rotorcraft p 193 N83-17480

DODGE, L. G.

Sooting tendency of fuels containing polycyclic aromatics in a research combustor p 225 A83-23138

DODGE, R. E.

Aircraft accident survivors as witnesses p 196 A83-20788

- DOMINIC, R. J.**
Analytical and experimental investigation of turbine blade damping
[AD-A120470] p 213 N83-16345
- DOMKE, A. E.**
Computerized engine and airplane performance monitoring programs p 188 N83-17465
- DONNELLY, J. P.**
Damage tolerance and reparability of advanced composite structures p 222 A83-20484
- DOOTSON, M.**
The development of advanced composite front fuselage technology p 202 A83-20464
- DOUP, P. W.**
General basic concepts for a trajectory simulation of a guided missile
[PML-1981-36] p 221 N83-17574
- DRESSER, M. M.**
Reconnaissance of the year 2000 and beyond p 186 A83-22577
- DZYGDALLO, Z.**
Finite element strength analysis of rotating shell-plate structures p 229 A83-21448

E

- EASTER, R. C.**
Composite design of an advanced airborne monitoring system
[DE82-006980] p 235 N83-18106
- EBERSOLE, J. F.**
Obscuration by helicopter-produced snow clouds p 197 A83-22357
- ECKERT, W. T.**
The aerodynamic performance of several flow control devices for internal flow systems
[NASA-TP-1972] p 221 N83-17560
- EDWARDS, J. W.**
Flight test results of an active flutter suppression system p 216 A83-22164
- EISMONT, V. A.**
The effect of the nonuniformity of supersonic flow with shocks on friction and heat transfer in the channel of a hypersonic ramjet engine p 211 A83-22654
- EJIRI, H.**
The estimation method on flutter boundary from subcritical random responses due to air turbulences
Problems of test procedures and data analysis
[NAL-TR-718] p 217 N83-17554
- ELIASSEN, R.**
A limited study of thrust vector control with guide vanes and jet rudder
[FOA-C-20455-E3] p 221 N83-16386
- EMERY, S. A.**
Material characterization Part B Mechanical properties of 2 metal matrix composite materials
[AD-A119829] p 225 N83-16402
- EMIN, O. N.**
Features of the selection of the basic parameters of cooled GTE turbines p 211 A83-22655
- ENGLE, R. M.**
An improved methodology for predicting random spectrum load interaction effects on fatigue crack growth p 224 A83-21802
- ERZBERGER, H.**
Automation of on-board flightpath management p 215 A83-21002
- Optimal short-range trajectories for helicopters
[NASA-TM-84303] p 187 N83-17451
- EVANS, A. G.**
A demonstration of relative positioning using conventional GPS Doppler receivers p 199 A83-19779
- EVSTIGNEEV, M. I.**
Fabrication technology for aircraft engines p 185 A83-20381

F

- FAETH, G. E.**
Effects of envelope flames on drop gasification rates in turbulent diffusion flames p 222 A83-19846
- FAN, H. S. L.**
Aircraft towing feasibility study p 207 N83-17458
- FASCHING, W. A.**
The CF6 engine performance improvement
[NASA-CR-165612] p 212 N83-16342
- Summary report for CF6 jet engine diagnostics program
[NASA-CR-165582] p 214 N83-17539
- FAVIER, D.**
Prediction and experimental verification of the velocity fields of a rotor during hovering p 193 N83-17477

- FERGUSON, D. R.**
A practical economic criterion for fuel conservation p 239 N83-17468
- FERNHOLZ, H.-H.**
A wind tunnel for unsteady turbulent shear flows - Design and flow calculation p 218 A83-19664
- FILIPCZAK, R.**
In-flight aircraft seat fire extinguishing tests (cabin hazard measurements)
[FAA-CT-82-111] p 197 N83-16308
- FISHER, R. W.**
Analysis of aero-optic interface phenomena p 190 A83-22588
- FLEMING, D. K.**
Coal gasification for stationary gas-turbine applications
[DE82-902135] p 226 N83-16553
- FOOTE, C. H.**
Flight evaluation of an engine static pressure noseprobe in an F-15 airplane
[NASA-CR-163109] p 214 N83-17546
- FORD, S. C.**
Technical and secretariat support of the MIL-STD-1515 fastener standardization effort
[AD-A119828] p 232 N83-16760
- FOSSI, M.**
Performance analysis of a dwell-time processor for monopulse beacon radars p 200 A83-22726
- Reply correlation test analysis in monopulse beacon radars p 200 A83-22727
- FOX, S. R.**
A study of optimum cowl shapes and flow port locations for minimum drag with effective engine cooling, volume 1
[NASA-CR-159379] p 191 N83-16288
- A study of optimum cowl shapes and flow port locations for minimum drag with effective engine cooling, volume 2
[NASA-CR-159380] p 191 N83-16289
- FRANZ, H. P.**
The half-model technique in the wind tunnel and its employment in the development of the airbus family
[NASA-TM-76970] p 205 N83-16328
- FROST, R. L.**
Observations of optical lightning emissions from above thunderstorms using U-2 aircraft p 234 A83-22703
- FUEHRING, H.**
Practical application of a model for fatigue damage with irregular cyclic loading p 224 A83-21757

G

- GAFFIN, W. O.**
The JT8D and JT9D engine component improvement
Performance improvement program
[NASA-CR-167965] p 214 N83-17543
- GAILFOIL, R. R.**
Evaluation of air-cooled Si3N4 vanes p 224 A83-22263
- GARRARD, W. L.**
Eigenspace techniques for active flutter suppression
[NASA-CR-169858] p 217 N83-17556
- GEDWILL, M. A.**
Coating with overlay metallic-cermet alloy systems
[NASA-CASE-LEW-13639-2] p 227 N83-17683
- GEYER, G. B.**
Equivalency evaluation of firefighting agents and minimum requirements at US Air Force airfields
[FAA-CT-82-109] p 198 N83-17524
- GIBSON, S. G.**
User's manual for master Modeling of aerodynamic surfaces by 3-dimensional explicit representation
[NASA-CR-166056] p 236 N83-18304
- GILL, W.**
Sandia Aircraft Crashfire Facility
[DE82-004297] p 198 N83-16313
- GILLASPY, P. H.**
Observations of optical lightning emissions from above thunderstorms using U-2 aircraft p 234 A83-22703
- GIULI, D.**
Performance analysis of a dwell-time processor for monopulse beacon radars p 200 A83-22726
- Reply correlation test analysis in monopulse beacon radars p 200 A83-22727
- GLASGOW, T. K.**
Coating with overlay metallic-cermet alloy systems
[NASA-CASE-LEW-13639-2] p 227 N83-17683
- GOLDBERG, J.**
The software-implemented fault tolerance /SIFT/ approach to fault tolerant computing p 235 A83-22825
- GOMER, F. E.**
Stimulus variables affecting dynamic target acquisition p 209 A83-22590
- GONCHAROV, I. N.**
Lasers in aviation p 229 A83-20384

- GOODMAN, S. J.**
Observations of optical lightning emissions from above thunderstorms using U-2 aircraft p 234 A83-22703
- GOVINDAN, T. R.**
Blade loading and rotation effects on compressor rotor wake near end walls p 190 A83-22138
- GOYAL, A.**
Coal gasification for stationary gas-turbine applications
[DE82-902135] p 226 N83-16553
- GRAF, P. A.**
Analytical and experimental investigation of turbine blade damping
[AD-A120470] p 213 N83-16345
- GRAHAM, J. M. R.**
A wind tunnel for unsteady turbulent shear flows - Design and flow calculation p 218 A83-19664
- GRANGAARD, J. L.**
Infrared calibration facilities at Newark Air Force Station p 219 A83-22875
- GRANOT, R.**
Effective aerodynamic parameter evaluation from free flight tests p 203 A83-21005
- GRANT, W. D.**
Advanced composite elevator for Boeing 727 aircraft, volume 2
[NASA-CR-159258] p 205 N83-16330
- GRAY, T. D.**
Damage tolerance assessment of the A-7D aircraft structure p 204 A83-21771
- GRENS, E. A., II**
Anti-misting additives for jet fuels
[NASA-CR-169751] p 225 N83-16417
- Viscometric and misting properties of polymer-modified fuel
[NASA-CR-169750] p 226 N83-16543
- GROENEWEG, J. F.**
Aircraft turbofan noise
[NASA-TM-83317] p 239 N83-18405
- GROESBECK, D. E.**
Conventional profile coaxial jet noise prediction p 237 A83-22128
- GRUENHAGEN, W. V.**
Comparison of rotor analysis results with aerodynamic windtunnel data p 194 N83-17487
- GRUNLING, H. W.**
The interaction of high temperature corrosion and mechanical properties of alloys p 224 A83-21470
- GUSTAVINO, T.**
In-flight aircraft seat fire extinguishing tests (cabin hazard measurements)
[FAA-CT-82-111] p 197 N83-16308

H

- HABASHI, W. G.**
A transonic quasi-3D analysis for gas turbine engines including split-flow capability for turbofans p 190 A83-22647
- HACKLER, L. W.**
Evaluation of supplemental lights for caution bars
[FAA-CT-82-119] p 220 N83-17559
- HADCOCK, R.**
Manufacturing processes for aeronautical structures p 227 N83-17620
- Specific examples of aerospace applications of composites p 227 N83-17621
- HAGEMAIER, D. J.**
Eddy current impedance plane analysis p 231 A83-22410
- HAHN**
Force initiations in helicopter rotor blades, wind channel fans and wind turbines
[MBB-UD-356-82-O] p 196 N83-17522
- HALE, P. L.**
A method to estimate weight and dimensions of small aircraft propulsion gas turbine engines User's guide
[NASA-CR-168049] p 213 N83-16343
- HALES, J. M.**
Composite design of an advanced airborne monitoring system
[DE82-006980] p 235 N83-18106
- HAMPTON, B. J.**
Benefits assessment of active control technology and related cockpit technology for rotorcraft
[NASA-CR-166406] p 217 N83-17553
- HANEY, D. G.**
Aircraft towing feasibility study p 207 N83-17458
- HANSON, G. P.**
An investigation and comparison of the aerodynamic performance of selected hang-glider airfoil sections
[BU-276] p 192 N83-16305
- HARESCEUGH, R. I.**
The development of advanced composite front fuselage technology p 202 A83-20464

HARGROVE, A.

- HARGROVE, A.**
Three computer based aids to maintenance scheduling
[AD-A120351] p 187 N83-16280
- HARPER, K. J.**
A study of the flow around a slotted flap end
[BU-278] p 192 N83-16306
- HARRIS, B.**
The nature of fibre composite materials
p 227 N83-17610
- HARRISON, E. S.**
A new high impact resin system for advanced composites with 300 F /150 C/ properties
p 222 N83-20429
- HARTMAN, B. O.**
An overview of human factors in aircraft accidents and investigative techniques
p 198 N83-17491
- HARVEY, S. T.**
Advanced composite elevator for Boeing 727 aircraft, volume 2
[NASA-CR-159258] p 205 N83-16330
- HATFIELD, C.**
Problems of representation of air traffic controllers in mid-air litigation
p 239 N83-21547
- HAVERDINGS, H.**
A control model for maneuvering flight for application to a computer flight testing program
[NLR-MP-81046-U] p 207 N83-17531
- HAYS, D. D.**
Sputtered ceramic coatings and sealing layers
[DE82-005225] p 226 N83-16531
- HEARON, B. F.**
Vertical impact tests of a modified F/B-111 crew seat to evaluate headrest position and restraint configuration effects
[AD-A120255] p 197 N83-16311
- HEINZE, F.**
Service operation of a CFRP window frame in short fiber pressing
[BMFT-FB-W-82-021] p 233 N83-17749
- HERMANN, B. R.**
A demonstration of relative positioning using conventional GPS Doppler receivers
p 199 N83-19779
- HERTEMAN, J. P.**
The simulation of fatigue loads in aeronautics
p 219 N83-23241
- HILL, R. G.**
In-flight aircraft seat fire extinguishing tests (cabin hazard measurements)
[FAA-CT-82-111] p 197 N83-16308
- HILLAKER, H. J.**
Technology and modern fighter aircraft - The evolutionary F-16
p 203 N83-20598
- HILLE, H. K.**
USAF Environmental Noise Data Handbook. Volume 150 C-140 in-flight crew noise
[AD-A120508] p 238 N83-17246
- USAF Bioenvironmental Noise Data Handbook. Volume 152 C-12A in-flight crew noise
[AD-A120509] p 238 N83-17247
- HINER, F. P., III**
Real-time multiradar simulation with a multiprocessor
p 200 N83-22824
- HOCH, C. J.**
An overview of the DOT/FAA aviation energy conservation policy
p 235 N83-17460
- HOHEISEL, H.**
The transonic wind tunnel Braunschweig of DFVLR
p 217 N83-19663
- HOLMES, R. E.**
Target TV projector with dynamic raster shaping for use in dome simulators
p 231 N83-22834
- HOPPER, L. C.**
A new high impact resin system for advanced composites with 300 F /150 C/ properties
p 222 N83-20429
- HORST, D.**
Slideslip indication system
p 210 N83-17466
- HUANG, J.-K.**
An optimal control approach to the design of moving flight simulators
p 218 N83-19949
- HUBER, C.**
In-flight aircraft seat fire extinguishing tests (cabin hazard measurements)
[FAA-CT-82-111] p 197 N83-16308
- HUBER, H.**
Studies on blade-to-blade and rotor-fuselage-tail interferences
p 193 N83-17479
- Transonic effects on helicopter rotor blades
[MBB-349-81-O-E] p 195 N83-17520
- Studies on blade-to-blade and rotor-fuselage-tail interferences
[MBB-351-82-O-E] p 195 N83-17521

- HUBER, J.**
Manufacturing processes for aeronautical structures
p 227 N83-17620
- Specific examples of aerospace applications of composites
p 227 N83-17621
- HUBER, P.**
The corrosion resistance of protective coatings
p 223 N83-21454
- HUGHES, R. G.**
Applications of simulator freeze to carrier glideslope tracking instruction
[AD-A118862] p 220 N83-16356

I

- IDELCHIK, I. E.**
Certain effects and paradoxes in aerodynamics and hydraulics
p 229 N83-20379
- IKEDA, T.**
Nonlinear forced oscillations of a rotating shaft carrying an unsymmetrical rotor at the major critical speed
p 228 N83-20288
- IRWIN, S. H.**
Results from tests, with van-mounted sensor, of magnetic leader cable for aircraft guidance during roll-out and turnoff
[NASA-TP-2092] p 209 N83-16338
- ISH-SHALOM, J.**
An optimal control approach to the design of moving flight simulators
p 218 N83-19949
- ISHIDA, Y.**
Nonlinear forced oscillations of a rotating shaft carrying an unsymmetrical rotor at the major critical speed
p 228 N83-20288
- ISHIGURO, T.**
Finite difference calculation of an inviscid transonic flow over oscillating airfoils
[RAE-TRANS-2087] p 191 N83-16292
- IVASHKEVICH, O. V.**
A test stand for studying transient phenomena in aerodynamic turbomachine cascades
p 218 N83-20913
- IWASAKI, M.**
Numerical calculations for performances of propellers in a static-state by vortex theory accounting of slipstream deformation and their companions with experiments
p 189 N83-22072

J

- JACHIMOWICZ, J.**
Application of the matrix method of forces for the calculation of aircraft structures
p 232 N83-23221
- JACOB, K.**
Computation of the flow around wings with rear separation
[DFVLR-FB-82-22] p 195 N83-17517
- JACOBSON, M. J.**
Sonic fatigue of advanced composite panels in thermal environments
p 224 N83-22166
- JAEL, R. F.**
Flight evaluation of an engine static pressure noseprobe in an F-15 airplane
[NASA-CR-163109] p 214 N83-17546
- JAMISON, E. S.**
Advanced composite elevator for Boeing 727 aircraft, volume 2
[NASA-CR-159258] p 205 N83-16330
- JARRETT, R. N.**
Effects of cobalt in nickel-base superalloys
p 223 N83-21467
- JAYARAMAN, N.**
Metallurgical instabilities during the high temperature low cycle fatigue of nickel-base superalloys
p 224 N83-22019
- JOHNSON, G.**
In-flight aircraft seat fire extinguishing tests (cabin hazard measurements)
[FAA-CT-82-111] p 197 N83-16308
- JOHNSON, G. A.**
Helicopter fin effectiveness
[BU-271] p 206 N83-16336
- JOHNSTON, M. H.**
Optical observations of unidirectional solidification in microgravity
[NASA-TP-2110] p 225 N83-16492
- JONES, C.**
Study of advanced rotary combustion engines for commuter aircraft
[NASA-CR-165399] p 214 N83-17545
- JONES, R.**
Analysis and repair of flaws in thick structures
p 230 N83-21654

PERSONAL AUTHOR INDEX

- JONES, W. R., JR.**
Analysis of a MIL-L-27502 lubricant from a gas-turbine engine test by size-exclusion chromatography
[NASA-TP-2063] p 226 N83-16528
- JUBERT, P.**
Optimization of the supersonic drag of a smooth wing by use of linearized potential theory
p 188 N83-20400
- JUNKER, B.**
Comparison of rotor analysis results with aerodynamic windtunnel data
p 194 N83-17487

K

- KAHMANN, J.**
Curvature transitions of composite curves and surfaces - Questions regarding details of computer-aided design
p 235 N83-20398
- KAMINER, A. A.**
A test stand for studying transient phenomena in aerodynamic turbomachine cascades
p 218 N83-20913
- KEIENBURGH, K. H.**
The interaction of high temperature corrosion and mechanical properties of alloys
p 224 N83-21470
- KELLEY, H. J.**
An on-board near-optimal climb-dash energy management
[NASA-CR-169755] p 205 N83-16329
- KERR, A. B.**
Plastic tooling for advanced composites
p 222 N83-20481
- KERR, A. W.**
The development of a system for interdisciplinary analysis of rotorcraft flight characteristics
p 236 N83-17485
- KHARIN, V. I.**
Electrical, avionics, and sensor equipment of the Yak-40 aircraft /2nd revised and enlarged edition/
p 208 N83-20390
- KIHARA, M.**
Extended perfect model following
p 235 N83-20289
- KIKUCHI, T.**
The estimation method on flutter boundary from subcritical random responses due to air turbulences
Problems of test procedures and data analysis
[NAL-TR-718] p 217 N83-17554
- KIRKLAND, J.**
Airport community soundproofing and relocation study
[PB82-259144] p 220 N83-16358
- KISNER, L. S.**
Computer program to predict noise of general aviation aircraft. User's guide
[NASA-CR-168050] p 238 N83-17242
- KIZER, J. A.**
Program for establishing long-time flight service performance of composite materials in the center wing structure of C-130 aircraft Phase 5 Flight service and inspection
[NASA-CR-165770] p 227 N83-17600
- KLOMPAS, N.**
Unbalance response analysis of a complete turbomachine
p 228 N83-19674
- KNAUSS, J. F.**
Demonstration of reparability and repair quality on graphite/epoxy structural subelements
p 186 N83-20485
- KNIGHT, R. S.**
Potential fuel savings through improved airframe maintenance
p 188 N83-17456
- KNOX, C. E.**
Planning fuel-conservative descents with or without time constraints using a small programmable calculator
Algorithm development and flight test results
[NASA-TP-2085] p 210 N83-17535
- KOCH, W.**
Eigensolutions for liners in uniform mean flow ducts
p 237 N83-19810
- KOCUREK, J. D.**
Velocity coupling A new concept for hover and axial flow wake analysis and design
p 193 N83-17478
- KOENIG, R. J.**
Airport noise Land-use compatibility by the year 2000
[PB82-259151] p 220 N83-16359
- KOENIG, R. W.**
Performance of high-altitude, long-endurance, turboprop airplanes using conventional or cryogenic fuels
[NASA-TM-84534] p 207 N83-17530
- KOLKMAN, H. J.**
Erosion of protective compressor coatings
[NLR-MP-87067-U] p 228 N83-17716
- Creep and fatigue interactions in a nickel base superalloy
[NLR-MP-82003-U] p 234 N83-17903

- KORETZ, D. B.**
Oceanic Area System Improvement Study (OASIS)
Volume 8 Central East Pacific region flight cost model
results
[FAA-EM-81-17-VOL-8] p 201 N83-16320
- KOZLOWSKI, D. R.**
The future for fighter aircraft p 186 A83-20597
- KREINDLER, E.**
Minimum-fuel turning climbout and descent guidance of
transport jets
[NASA-TM-84289] p 217 N83-17552
- KREISSELMEIER, G.**
Application of vector performance optimization to a
robust control loop design for a fighter aircraft
p 215 A83-21160
- KRIJN, R.**
The F29 flight test instrumentation and data processing
system. An overview of requirements, design and
organization
[NLR-MP-81035-U] p 209 N83-16340
- KRUMWEIDE, G. C.**
Graphite/epoxy material characteristics and design
techniques for airborne instrument application
p 225 A83-22595
- KUBOTA, S.**
Numerical calculations for performances of propellers
in a static-state by vortex theory accounting of slipstream
deformation and their companions with experiments
p 189 A83-22072
- KURZ, K. H.**
Improved fault detection in the hot section of turbojet
engines by individual monitoring procedures
p 210 A83-19666
- KURZINER, R. I.**
Theory and design of flight-vehicle engines
p 211 A83-22651
- KUTAKHOV, V. P.**
Lasers in aviation p 229 A83-20384

L

- LA RUSSA, J.**
Two years of training with the first true three-dimensional
simulator p 218 A83-22833
- LA VASSAR, L.**
A concept for reducing helicopter IFR landing weather
minimums - Onshore p 199 A83-21034
- LAFLEN, J. R.**
Equivalent damage A critical assessment
[NASA-CR-167874] p 214 N83-17542
- LAKHIN, B. F.**
A rapid method for determining the initial boiling point
and the saturated-vapor pressure of petroleum products
p 229 A83-20962
- LAKSHMINARAYANA, B.**
Blade loading and rotation effects on compressor rotor
wake near end walls p 190 A83-22138
- LANCASTER, J. W.**
Naval Airship Program for Sizing and Performance
(NAPSAP), computer program development. Program
update number 2
[AD-A120830] p 191 N83-16293
- LAND, K. L.**
Electrical discharge machining of aluminum honeycomb
core p 229 A83-20500
- LANG, W.**
An interactive system for transformation of known
measures long internal surface of cylinders model for
shafts
[ISD-294] p 233 N83-17748
- LANGER, H. J.**
Comparison of rotor analysis results with aerodynamic
windtunnel data p 194 N83-17487
- LAPP, H.**
Real-time reconnaissance - A systems look at advanced
technology p 200 A83-22576
- LARGE, R.**
Wind tunnel investigation of the transonic aerodynamic
characteristics of forward swept wings
p 190 A83-22153
- LARSON, E. S.**
Embedded flow characteristics of sharp-edged
rectangular wings p 190 A83-22152
- LEE, R. N.**
Composite design of an advanced airborne monitoring
system
[DE82-006980] p 235 N83-18106
- LEN, A. D.**
A test stand for studying transient phenomena in
aerodynamic turbomachine cascades p 218 A83-20913
- LENER, E. J.**
The automated cockpit p 208 A83-20849

- LEVINE, S. R.**
Coating with overlay metallic-cermet alloy systems
[NASA-CASE-LEW-13639-2] p 227 N83-17683
- LEWY, S.**
Theoretical and experimental study of helicopter rotor
noise
[ONERA, TP NO 1982-74] p 205 A83-23247
- LIBESKIND, M.**
Serviceability evaluation of advanced composite F-14A
main-landing-gear-strut doors and overwing fairings
p 185 A83-20480
- LIEBST, B. S.**
Eigenspace techniques for active flutter suppression
[NASA-CR-169858] p 217 N83-17556
- LIMBACH, P., JR.**
Vibration-free internal combustion engine for general
aviation
[BMFT-FB-W-82-016] p 213 N83-16347
- LINDBLOM, Y.**
Fatigue failure under fretting conditions
p 224 A83-21481
- LINTERN, G.**
Applications of simulator freeze to carrier glideslope
tracking instruction
[AD-A118862] p 220 N83-16356
- LIU, G. C.**
Performance of high-altitude, long-endurance, turboprop
airplanes using conventional or cryogenic fuels
[NASA-TM-84534] p 207 N83-17530
- LOEBERT, G.**
Theory of resistance interference of airfoil wings and
engine exhaust p 188 A83-19667
- LOEWY, R. G.**
Composite structural materials
[NASA-CR-169859] p 226 N83-17597
- LONG, W. H., III**
F-16 pulse Doppler radar /AN/APG-66/ performance
p 200 A83-22737
- LOUDENSLAGER, L. E.**
Advanced composite materials in aerobatic aircraft
p 203 A83-20496
- LU, H. Y.**
Effect of excitation on coaxial jet noise
p 237 A83-19811
- LUKASHENKO, V. I.**
A superelement analysis of stiffened shells
p 202 A83-20392
- LURIA, S. M.**
Desirable characteristics of underwater lights for
helicopter escape hatches
[AD-A120331] p 197 N83-16310
- LYON, C. A.**
Desirable characteristics of underwater lights for
helicopter escape hatches
[AD-A120510] p 198 N83-16312
- LYON, C. A.**
Computer program to predict noise of general aviation
aircraft User's guide
[NASA-CR-168050] p 238 N83-17242

M

- MAGENHEIM, B.**
Microwave Ice Accretion Measurement Instrument
/MIAMI/ p 208 A83-22163
- MAHON, J.**
Serviceability evaluation of advanced composite F-14A
main-landing-gear-strut doors and overwing fairings
p 185 A83-20480
- MALIK, M.**
The corrosion resistance of protective coatings
p 223 A83-21454
- MALONEY, W. T.**
The development of standards for the common ICAO
Data Interchange Network /CIDIN/ p 230 A83-22027
- MALOV, B. A.**
A rapid method for determining the initial boiling point
and the saturated-vapor pressure of petroleum products
p 229 A83-20962
- MANCUS, E. F.**
Mode S baseline radar tracking
[FAA-RD-82-53] p 233 N83-17770
- MANDERS, P. J.**
The on-board computer system for the F29 prototype
flight test
[NLR-MP-81034-U] p 209 N83-16339
- MARESCA, C.**
Prediction and experimental verification of the velocity
fields of a rotor during hovering p 193 N83-17477
- MARR, P. R.**
Computer-generated images in visual simulation and
avionic technologies p 219 A83-22835
- MARTENEY, P. J.**
Experimental study of the thermal stability of
hydrocarbon fuels
[NASA-CR-168027] p 228 N83-17728

- MAST, P. W.**
The effect of loading rates, temperature and moisture
on the fracture toughness of polycarbonate p 223 A83-20497
- MASURE, B.**
Methods used at Aerospatiale for calculating the loads
on a rotor and experimental cross checks
p 194 N83-17486
- MATSUZAKI, Y.**
The estimation method on flutter boundary from
subcritical random responses due to air turbulences:
Problems of test procedures and data analysis
[NAL-TR-718] p 217 N83-17554
- MAYS, J. A.**
Calligraphic/raster color display for simulation
p 231 A83-22832
- MBA, M. N.**
Prediction and experimental verification of the velocity
fields of a rotor during hovering p 193 N83-17477
- MCAYOY, J.**
Acoustic environment in large enclosures with a small
opening exposed to flow p 237 A83-22161
- MCCALL, D. L.**
Cockpit weather radar display demonstrator and
ground-to-air sfencs telemetry system
[NASA-CR-169830] p 210 N83-17534
- MCCARTY, J. E.**
Advanced composite elevator for Boeing 727 aircraft,
volume 2
[NASA-CR-159258] p 205 N83-16330
- MCCORMICK, D.**
Pilot task profiles, human factors, and image realism
p 219 A83-22836
- MCCRACKEN, W.**
Future trends in the use of infrared line scanners for
airborne reconnaissance p 209 A83-22578
- MCGHEE, R. J.**
Low-speed aerodynamic characteristics of a
17-percent-thick medium speed airfoil designed for general
aviation applications
[NASA-TP-1786] p 191 N83-16290
- MCGOWAN, L. A.**
Vertical impact tests of a modified F/FB-111 crew seat
to evaluate headrest position and restraint configuration
effects
[AD-A120255] p 197 N83-16311
- MCKINLEY, J. B.**
The analysis of integrated fuel efficient, low noise
procedures in lax terminal area operations
p 202 N83-17459
- MCKINNEY, S. C.**
Two years of training with the first true three-dimensional
simulator p 218 A83-22833
- MCLAREN, S. W.**
An investigation and comparison of the aerodynamic
performance of selected hang-glider airfoil sections
[BU-276] p 192 N83-16305
- MCNILLAN, O. J.**
Blade erosion effects on aircraft-engine compressor
performance
[DE82-021791] p 213 N83-16346
- MEECHAM, W. C.**
Development of a procedure for calculating the effects
of airfoil erosion on aircraft engine compressor
performance p 213 N83-17457
- MEECHAM, W. C.**
Aerosound from corner flow and flap flow
[AIAA PAPER 81-2039] p 237 A83-19813
- MEINEKE, E.**
The wake of a sideslipping wing in low speed flow
[VKI-TN-143] p 192 N83-16301
- MEISTER, N.**
F-104 CCV research flight test program
p 215 A83-20074
- MENDELSON, M. I.**
Evaluation of air-cooled Si3N4 vanes
p 224 A83-22263
- MERKLEY, D. J.**
DATAMAP and its impact on prediction programs
p 236 N83-17489
- MIKULLA, V.**
Transonic effects on helicopter rotor blades
[MBB-349-81-O-E] p 195 N83-17520
- MILLER, R. H.**
Rotor hovering performance using the method of fast
free wake analysis p 190 A83-22162
- MILLER, R. H.**
Simplified free wake analysis for rotors
[FFA-TN-1982-07] p 195 N83-17518
- MITCHELL, J. A.**
Computer program to predict noise of general aviation
aircraft. User's guide
[NASA-CR-168050] p 238 N83-17242
- MOEHRING, W.**
Eigensolutions for liners in uniform mean flow ducts
p 237 A83-19810

MOFFITT, T. P.

Aerodynamic effect of a honeycomb rotor tip shroud on a 50 8-centimeter-tip-diameter core turbine
[NASA-TP-2112] p 215 N83-17547

MONGEON, R. J.

Multifunction CO₂ laser radar technology p 208 A83-22502

MONTGOMERY, D. W.

Advanced tactical air reconnaissance system p 186 A83-22575

MOONEY, D. H.

F-16 pulse Doppler radar /AN/APG-66/ performance p 200 A83-22737

MORALES, W.

Analysis of a MIL-L-27502 lubricant from a gas-turbine engine test by size-exclusion chromatography [NASA-TP-2063] p 226 N83-16528

MORBIOLI, R.

The corrosion resistance of protective coatings p 223 A83-21454

MORDOFF, K. F.

Researchers study methods to combat effects of wind shear p 196 A83-22175

MORRIS, C. E. K., JR.

Performance of high-altitude, long-endurance, turboprop airplanes using conventional or cryogenic fuels [NASA-TM-84534] p 207 N83-17530

MORRIS, C. E. M.

Aging and performance of structural film adhesives I - A comparison of two high-temperature curing, epoxy-based systems p 223 A83-21048

MORT, K. W.

The aerodynamic performance of several flow control devices for internal flow systems [NASA-TP-1972] p 221 N83-17560

MOSES, C. A.

Sooting tendency of fuels containing polycyclic aromatics in a research combustor p 225 A83-23138

MOSS, R. W.

Sputtered ceramic coatings and sealing layers [DE82-005225] p 226 N83-16531

MUELLER, R.

The transonic wind tunnel Braunschweig of DFVLR p 217 A83-19663

MUNRO, N.

Design of an integrated control system for a supersonic aircraft power plant p 212 A83-23175

MYERS, D.

Study of advanced rotary combustion engines for commuter aircraft [NASA-CR-165399] p 214 N83-17545

N**NAEGELI, D. W.**

Sooting tendency of fuels containing polycyclic aromatics in a research combustor p 225 A83-23138

NAGABHUSHAN, B. L.

Dynamic stability of a buoyant quad-rotor aircraft p 216 A83-22160

NAHM, A. H.

Bearing fatigue investigation 3 [NASA-CR-168029] p 233 N83-17880

NATAN, M.

Effect of moisture on adhesively bonded titanium structures p 222 A83-20442

NEISWANDER, P.

A pilot study of human response to general aviation aircraft noise [NASA-CR-166053] p 238 N83-18404

NELUBOV, A. I.

Aircraft maneuver mechanics with turning of the power-plant thrust vector p 216 A83-22076

NELSON, P. K.

Primary bonded aircraft wing construction p 186 A83-20493

NERI, D. F.

Desirable characteristics of underwater lights for helicopter escape hatches [AD-A120331] p 197 N83-16310

Desirable characteristics of underwater lights for helicopter escape hatches [AD-A120510] p 198 N83-16312

NETZER, D. W.

An investigation of the effectiveness of smoke suppressant fuel additives for turbojet applications [AD-A121228] p 215 N83-17549

NEUBERT, H. D.

Advanced composite materials in aerobatic aircraft p 203 A83-20496

NEUMAN, F.

Minimum-fuel turning climbout and descent guidance of transport jets [NASA-TM-84289] p 217 N83-17552

NEUMANN, H. E.

An analytical and experimental comparison of the flow field of an advanced swept turboprop [AIAA PAPER 83-0189] p 189 A83-21080

NG, T. D.

The effect of primer-adhesive compatibility on adhesive peel strength at low temperature p 222 A83-20448

NICKUM, J. D.

Cockpit weather radar display demonstrator and ground-to-air sfence telemetry system [NASA-CR-169830] p 210 N83-17534

NIX, B. G.

B-52 roles in sea control p 186 A83-20646

NORDEEN, L.

Thirty years of fighter armament p 203 A83-20600

NORGREN, C. T.

Effect of broad properties fuel on injector performance in a reverse flow combustor [AIAA PAPER 83-0154] p 210 A83-21079

NORUM, T. D.

Screach suppression in supersonic jets p 237 A83-19814

NOTON, B. R.

USAF's design guide coming out next month p 239 A83-20647

NOWOTARSKI, I.

Finite element strength analysis of rotating shell-plate structures p 229 A83-21448

O**OBRAZTSOV, I. F.**

Aircraft maneuver mechanics with turning of the power-plant thrust vector p 216 A83-22076

OKADA, T.

Extended perfect model following p 235 A83-20289

OLSSON, W. J.

The JT9D Jet Engine Diagnostics Program [NASA-CR-167966] p 214 N83-17544

ONEILL, J.

Equivalency evaluation of firefighting agents and minimum requirements at US Air Force airfields [FAA-CT-82-109] p 198 N83-17524

ORVILLE, R. E.

Observations of optical lightning emissions from above thunderstorms using U-2 aircraft p 234 A83-22703

OSTRAS, V. N.

The effect of the nonuniformity of supersonic flow with shocks on friction and heat transfer in the channel of a hypersonic ramjet engine p 211 A83-22654

OTTENS, H. H.

Predicted and measured landing gear loads for the NF-5 aircraft taxiing over a bumpy runway [NLR-MP-82008-U] p 207 N83-17532

OWEN, R. B.

Optical observations of unidirectional solidification in microgravity [NASA-TP-2110] p 225 N83-16492

OYIBO, G. A.

Flutter of orthotropic panels in supersonic flow using affine transformations p 228 A83-19821

P**PARADIS, D. L.**

The effect of primer-adhesive compatibility on adhesive peel strength at low temperature p 222 A83-20448

PARIS, J. F.

Program to compute the positions of the aircraft and of the aircraft sensor footprints [E83-10139] p 234 N83-16814

PARKER, R. J.

Rolling-element fatigue life of AMS 5900 balls [NASA-TP-2080] p 232 N83-16758

PATTEN, J. W.

Sputtered ceramic coatings and sealing layers [DE82-005225] p 226 N83-16531

PAVLENKO, V. F.

Aircraft maneuver mechanics with turning of the power-plant thrust vector p 216 A83-22076

PEARCE, P. J.

Aging and performance of structural film adhesives I - A comparison of two high-temperature curing, epoxy-based systems p 223 A83-21048

PEARCE, W. E.

Evaluation of laminar flow control systems for subsonic commercial transport aircraft: Executive summary [NASA-CR-159252] p 216 N83-17551

PELEG, I.

Investigation of slurry fuel performance for use in a ramjet propulsor p 223 A83-21014

PELLISSIER TANON, A.

Practical application of fracture mechanics p 230 A83-21799

PENZIN, V. I.

On the choice of the optimal total wedge angle for the air intake of a hypersonic ramjet engine p 212 A83-22656

PERSHING, B. M.

Potential fuel savings through improved airframe maintenance p 188 N83-17456

PETIT, J. L.

CINNA - A system for preparing reconnaissance missions p 200 A83-22591

PETUKHOV, A. V.

Lasers in aviation p 229 A83-20384

PHILIPPE, J. J.

Studies of aerofoils and blade tips for helicopters p 193 N83-17473

PODZEI, A. V.

Fabrication technology for aircraft engines p 185 A83-20381

POLZ, G.

The calculation of separated flow at helicopter bodies [NASA-TM-76715] p 191 N83-16291

Studies on blade-to-blade and rotor-fuselage-tail interferences p 193 N83-17479

Studies on blade-to-blade and rotor-fuselage-tail interferences [MBB-351-82-O-E] p 195 N83-17521

POON, V.

A laboratory method for the analysis of helicopter underwing load oscillations [BU-273] p 192 N83-16303

POWELL, C. A.

Multiple-event airplane noise annoyance [NASA-TP-2101] p 234 N83-16951

POWELL, D. M.

Design considerations for the construction of a Sherriff wing in composite materials [BU-280] p 206 N83-16337

POWERS, J. M.

Vertical impact tests of a modified F/FB-111 crew seat to evaluate headrest position and restraint configuration effects [AD-A120255] p 197 N83-16311

PRATER, J. T.

Sputtered ceramic coatings and sealing layers [DE82-005225] p 226 N83-16531

PRICE, E. H.

Air traffic control Its effect on fuel conservation p 232 N83-17464

PUFFERT-MEISSNER, W.

The transonic wind tunnel Braunschweig of DFVLR p 217 A83-19663

PYNCHON, G. E.

Graphite/epoxy material characteristics and design techniques for airborne instrument application p 225 A83-22595

Q**QUARLES, J. D.**

Aircraft inspection using radiography p 185 A83-20478

R**RADDIN, J. H., JR.**

Vertical impact tests of a modified F/FB-111 crew seat to evaluate headrest position and restraint configuration effects [AD-A120255] p 197 N83-16311

RAGOSTA, A. E.

DATAMAP and its impact on prediction programs p 236 N83-17489

RAJALA, S. A.

A study of real-time computer graphic display technology for aeronautical applications [NASA-CR-169828] p 236 N83-18307

RAJU, B. B.

Analytical and experimental investigation of turbine blade damping [AD-A120470] p 213 N83-16345

RAJU, P. K.

Theoretical and experimental evaluation of transmission loss of cylinders p 237 A83-19808

RAND, O.

The aeroelastic behavior of curved helicopter blades in hovering and axial flight p 203 A83-21017

RAND, U.

Prediction of the aerodynamic loads on helicopter blades in hovering and axial flight using lifting line theory p 189 A83-21016

RAWLS, J. W., JR.

Comparison of forward flight effects theory of A Michalke and U Michel with measured data [NASA-CR-3665] p 238 N83-17239

- REAMER, R. E.**
United States Air Force tactical reconnaissance - An analysis and commentary p 186 A83-22574
- REBBECCHI, B.**
Cockpit temperatures and cooling requirements of a packed aircraft [ARL-MECH-ENG-NOTE-388] p 205 N83-16327
- REED, R. E.**
The Hummercraft p 204 A83-21033
- REICHERT, G.**
Survey of active and passive means to reduce rotorcraft vibrations [MBB-UD-350] p 206 N83-16335
- REPACHOLI, N. J.**
Cockpit temperatures and cooling requirements of a packed aircraft [ARL-MECH-ENG-NOTE-388] p 205 N83-16327
- REYNOLDS, B.**
Blade loading and rotation effects on compressor rotor wake near end walls p 190 A83-22138
- RICE, E. J.**
Aircraft turbofan noise [NASA-TM-83317] p 239 N83-18405
- RICKETTS, R. H.**
Structural testing for static failure, flutter and other scary things [NASA-TM-84606] p 234 N83-17899
- RIDDLEBAUGH, S. M.**
Effect of broad properties fuel on injector performance in a reverse flow combustor [AIAA PAPER 83-0154] p 210 A83-21079
- RINGEL, M. B.**
F-16 pulse Doppler radar /AN/APG-66/ performance p 200 A83-22737
- RIVIERE, W. P., JR.**
CTOL, STOL, V/STOL - An operational companion for forward deployed CVNs p 196 A83-22157
- RIZZETTA, D. P.**
Unsteady transonic flow over wings including inviscid/viscous interaction p 190 A83-22132
- ROBERT, J. P.**
Fuselage-lifting surfaces interaction in unsteady subsonic flow p 189 A83-22093
- ROBERTS, L.**
Elevated temperature repairs of advanced composite structures p 223 A83-20499
- ROBERTS, W. B.**
Turbine engine fuel conservation by fan and compressor profile control p 213 N83-17467
- ROBINSON, S. P.**
Advanced Ultra-Violet (UV) aircraft fire detection system Volume 1 System description and flight test [AD-A121253] p 198 N83-17526
- ROCKS, J. K.**
Microwave Ice Accretion Measurement Instrument /MIAMI/ p 208 A83-22163
- ROGERS, W.**
Turbine engine fuel conservation by fan and compressor profile control p 213 N83-17467
- ROGERS, W. A.**
Design, analyses, and model tests of an aeroelastically tailored lifting surface p 204 A83-22155
- ROMBERG, G.**
Gas turbine combustor modelling for calculating pollutant emission p 212 A83-23142
- RONK, L.**
Airport community soundproofing and relocation study [PB82-259144] p 220 N83-16358
- ROSEN, A.**
Prediction of the aerodynamic loads on helicopter blades in hovering and axial flight using lifting line theory p 189 A83-21016
- ROSENBERG, R.**
The aeroelastic behavior of curved helicopter blades in hovering and axial flight p 203 A83-21017
- ROSENTHAL, G.**
A simplified model of the influence of elastic pitch variations on the rotor flapping dynamics p 204 A83-21025
- ROSENBERG, R.**
Equivalent G/E of helicopter rotor blades p 230 A83-22151
- ROSENBERG, R.**
The MCA method, a flight test technique to determine the thrust of jet aircraft in flight p 202 A83-19661
- ROSENTHAL, G.**
NGT - The Next Generation Trainer p 203 A83-20599
- RUSAK, Z.**
Numerical calculations of nonlinear aerodynamics of wing-body configurations p 189 A83-21022
- RUSSO, A.**
First results for the definition of a general rotorcraft dynamic program p 236 N83-17483
- RYACK, B. L.**
Desirable characteristics of underwater lights for helicopter escape hatches [AD-A120331] p 197 N83-16310
- Desirable characteristics of underwater lights for helicopter escape hatches [AD-A120510] p 198 N83-16312**
- S**
- SAHAI, B.**
Remote sensing of problem birds in aviation p 196 A83-21876
- SANDERS, W. D.**
Primary bonded aircraft wing construction p 186 A83-20493
- SARKOS, C.**
In-flight aircraft seat fire extinguishing tests (cabin hazard measurements) [FAA-CT-82-111] p 197 N83-16308
- SAWTELLE, E. M.**
Fixed wing and rotary wing flight testing of Navstar GPS as a civilian navigation system p 199 A83-19777
- SCHAMELHOUT, J. G.**
Evaluation of lubricants for air compressors [PB82-259003] p 226 N83-16538
- SCHILLING, H.**
Supersonic maneuvers without superbooms p 189 A83-21021
- SCHOOLEY, B.**
Flight preparation and planning p 188 N83-17462
- SCHROEDER, L. G.**
Dynamic structural aeroelastic stability testing of the XV-15 tilt rotor research aircraft [NASA-TM-84293] p 216 N83-16349
- SCHUCH, G.**
The MCA method, a flight test technique to determine the thrust of jet aircraft in flight p 202 A83-19661
- SCHWARTZ, M. B.**
Computerized engine and airplane performance monitoring programs p 188 N83-17465
- SCHWEITZER, K. K.**
The interaction of high temperature corrosion and mechanical properties of alloys p 224 A83-21470
- SCHWEIZER, F.**
Calibration support of the AN/AAM-60 common forward-looking infrared /FLIR/ test bench p 232 A83-22886
- SCHWIND, R. G.**
Blade erosion effects on aircraft-engine compressor performance [DE82-021791] p 213 N83-16346
- SEARS, J. R.**
Design of an integrated control system for a supersonic aircraft power plant p 212 A83-23175
- SEELEY, P. E.**
Electro-optical calibration considerations at intermediate maintenance levels p 232 A83-22883
- SEGINER, A.**
Numerical calculations of nonlinear aerodynamics of wing-body configurations p 189 A83-21022
- SELWOOD, J.**
Airport community soundproofing and relocation study [PB82-259144] p 220 N83-16358
- SENECHAL, P.**
Fatigue and creep considerations in the design of turbine components p 230 A83-21461
- SERAFINI, J. S.**
An analytical and experimental comparison of the flow field of an advanced swept turboprop [AIAA PAPER 83-0189] p 189 A83-21080
- SHAPIRO, E. Y.**
Constrained eigenvalue/eigenvector assignment - Application to flight control systems p 215 A83-21006
- SHARPSTEEN, J. T.**
Analysis of target coverage for an unstabilized 35 mm panoramic strike camera p 231 A83-22596
- SHAW, L.**
Acoustic environment in large enclosures with a small opening exposed to flow p 237 A83-22161
- SHAW, R. J.**
Turbofan blade stresses induced by the flow distortion of a VTOL inlet at high angles of attack [NASA-TM-82963] p 194 N83-17509
- SHEATH, P. H.**
Advanced Ultra-Violet (UV) aircraft fire detection system. Volume 1 System description and flight test [AD-A121253] p 198 N83-17526
- SHEENA, Z.**
Theoretical stiffness matrix correction by using static test results p 229 A83-21007
- SHIKHAN, IU. M.**
Errors in the experimental determination of the parameters of supersonic combustion ramjet engines p 211 A83-22653
- SHIRK, M. H.**
Design, analyses, and model tests of an aeroelastically tailored lifting surface p 204 A83-22155
- SHIVASHANKARA, B. N.**
High bypass ratio engine noise component separation by coherence technique p 211 A83-22159
- SHURNEY, R. E.**
Optical observations of unidirectional solidification in microgravity [NASA-TP-2110] p 225 N83-16492
- SIDORIN, V. M.**
Lasers in aviation p 229 A83-20384
- SIERAK, P.**
USAF ground fiber optic development program p 228 A83-19711
- SIGNER, H.**
Bearing fatigue investigation 3 [NASA-CR-168029] p 233 N83-17880
- SIMPSON, W. E.**
Research and technology program perspectives for general aviation and commuter aircraft [NASA-CR-169875] p 187 N83-17454
- SINGH, H. B.**
Bird strikes to aircraft and associated hazards and problems regarding the safety of aircraft operations p 196 A83-21878
- SINGLETON, J.**
Applications of simulator freeze to carrier glideslope tracking instruction [AD-A118862] p 220 N83-16356
- SIVAN, R.**
An optimal control approach to the design of moving flight simulators p 218 A83-19949
- SLATER, G. L.**
Optimal short-range trajectories for helicopters [NASA-TM-84303] p 187 N83-17451
- SLEEMAN, J. R.**
A study of the flow around a slotted flap end [BU-279] p 192 N83-16306
- SMETANA, F. O.**
A study of optimum cowl shapes and flow port locations for minimum drag with effective engine cooling, volume 1 [NASA-CR-159379] p 191 N83-16288
- SMETANA, F. O.**
A study of optimum cowl shapes and flow port locations for minimum drag with effective engine cooling, volume 2 [NASA-CR-159380] p 191 N83-16289
- SMITH, A. J.**
Development of the precision approach path indicator light unit [RAE-TM-FS(B)-483] p 202 N83-17527
- SMITH, A. P., III**
Conflict monitoring analysis of parallel opposite direction routes, volume 2 [AD-A120187] p 202 N83-16323
- SMITH, D. J. V.**
Advanced Ultra-Violet (UV) aircraft fire detection system Volume 1 System description and flight test [AD-A121253] p 198 N83-17526
- SNELL, M. B.**
Initial design of stringer stiffened bend boxes using geometric programming p 232 A83-23149
- SOLOVEV, A. N.**
A rapid method for determining the initial boiling point and the saturated-vapor pressure of petroleum products p 229 A83-20962
- SOMMER, E.**
Practical application of fracture mechanics p 230 A83-21799
- SOON, J.**
A laboratory method for the analysis of helicopter underslung load oscillations [BU-273] p 192 N83-16303
- SOPHER, R.**
Review of rotor loads prediction methods p 194 N83-17484
- SPEARMAN, M. L.**
Effect of external stores on the stability and control characteristics of a delta wing fighter model at Mach numbers from 0.60 to 2.01 [NASA-TM-84596] p 194 N83-17508
- SPEARMAN, M. L.**
The minimization of pylon-mounted store effects on air combat capability [NASA-TM-84597] p 195 N83-17510
- SPEIR, D. W.**
Internal performance prediction for advanced exhaust systems p 211 A83-22156
- SPEITEL, L. C.**
In-flight aircraft seat fire extinguishing tests (cabin hazard measurements) [FAA-CT-82-111] p 197 N83-16308
- SPERA, T. J.**
Thermal infrared pushbroom imagery acquisition and processing p 209 A83-22841
- SPRINGER, R. J.**
Advanced Ultra-Violet (UV) aircraft fire detection system Volume 1 System description and flight test [AD-A121253] p 198 N83-17526

STAHL, H.

Calculation of 3D unsteady transonic flow around rotor blades p 193 N83-17474

Transonic effects on helicopter rotor blades [MBB-349-81-O-E] p 195 N83-17520

STAKUN, V. J.
Electro-optical calibration considerations at intermediate maintenance levels p 232 A83-22883

STANEWSKY, E.
The transonic wind tunnel Braunschweig of DFVLR p 217 A83-19663

STARRY, C.
Oceanic Area System Improvement Study (OASIS) Volume 10 North Atlantic, Central East Pacific, and Caribbean regions aviation traffic forecasts [FAA-EM-81-17-VOL-10] p 201 N83-16322

STEARNS, J.
A pilot study of human response to general aviation aircraft noise [NASA-CR-166053] p 238 N83-18404

STEINHAUSER, R.
Application of vector performance optimization to a robust control loop design for a fighter aircraft p 215 A83-21160

STELMAKH, A. L.
A test stand for studying transient phenomena in aerodynamic turbomachine cascades p 218 A83-20913

STEMMER, G.
Service operation of a CFRP window frame in short fiber pressing [BMFT-FB-W-82-021] p 233 N83-17749

STEPHENS, W. B.
The development of a system for interdisciplinary analysis of rotorcraft flight characteristics p 236 N83-17485

STEPHENSON, J. D.
The application of parameter estimation to flight measurements to obtain lateral-directional stability derivatives of an augmented jet-flap STOL airplane [NASA-TP-2033] p 216 N83-16350

STICHTER, M. C.
Evaluation of helicopter pilot's attitude control using a simulated head-up display in a simulated helicopter cockpit [AD-A119570] p 219 N83-16355

STIELER, B.
Gyroscopic instruments and their application to flight testing [AGARD-AG-160-VOL-15] p 233 N83-17855

STONE, J. R.
Conventional profile coaxial jet noise prediction p 237 A83-22128

STONE, R. H.
Demonstration of reparability and repair quality on graphite/epoxy structural subelements p 186 A83-20485

Repair techniques for graphite/epoxy structures for commercial transport applications [NASA-CR-159056] p 225 N83-16397

STRANG, A.
High temperature stability of pack aluminide coatings on IN38LC p 230 A83-21459

STREHLOW, H.
Survey of active and passive means to reduce rotorcraft vibrations [MBB-UD-350] p 206 N83-16335

STRICKLIN, R.
Summary report for CF6 jet engine diagnostics program [NASA-CR-165582] p 214 N83-17539

STROKIN, M. V.
Errors in the experimental determination of the parameters of supersonic combustion ramjet engines p 211 A83-22653

STUMM, J. E.
Graphite/epoxy material characteristics and design techniques for airborne instrument application p 225 A83-22595

SUKHAR, I. M.
Lasers in aviation p 229 A83-20384

SULIMA, A. M.
Fabrication technology for aircraft engines p 185 A83-20381

SULLIVAN, T. J.
Energy efficient engine: Fan test hardware detailed design report [NASA-CR-165148] p 212 N83-16341

SUTTON, S. A.
The effect of loading rates, temperature and moisture on the fracture toughness of polycarbonate p 223 A83-20497

SYDER, H.
Advanced composite elevator for Boeing 727 aircraft, volume 2 [NASA-CR-159258] p 205 N83-16330

SYLMAN, Y.

Effective aerodynamic parameter evaluation from free flight tests p 203 A83-21005

SZAMOSI, M.

An improved methodology for predicting random spectrum load interaction effects on fatigue crack growth p 224 A83-21802

SZEKELY, G. A., JR.

Effects of envelope flames on drop gasification rates in turbulent diffusion flames p 222 A83-19846

SZUMANSKI, K.

A simulation model for the analysis of the dynamic behavior of a helicopter rotor under nonstationary limit flight conditions p 204 A83-23220

T

TABAKOFF, W.

Compressor cascade performance deterioration caused by sand ingestion [NASA-CR-168067] p 190 N83-16286

THIBERT, J. J.

Studies of aerofoils and blade tips for helicopters p 193 N83-17473

THOMAS, D. L.

Computer based maintenance aids system Preliminary development and evaluation of a prototype [AD-A120627] p 187 N83-16281

THOMAS, R. W.

The effect of loading rates, temperature and moisture on the fracture toughness of polycarbonate p 223 A83-20497

THOMSON, J. M.

The electrical properties of carbon fibre composites p 227 N83-17618

TIEN, J. K.

Effects of cobalt in nickel-base superalloys p 223 A83-21467

TILL, R. D.

Fixed wing and rotary wing flight testing of Navstar GPS as a civilian navigation system p 199 A83-19777

TIMNAT, Y. M.

Investigation of slurry fuel performance for use in a ramjet propulsor p 223 A83-21014

TIMOFEEV, M. T.

A superelement analysis of stiffened shells p 202 A83-20392

TIROSH, J.

The effect of loading rates, temperature and moisture on the fracture toughness of polycarbonate p 223 A83-20497

TOENSKOETTER, H.

Improved fault detection in the hot section of turbojet engines by individual monitoring procedures p 210 A83-19666

TOMASZEWICZ, P.

Identification of certain dynamic characteristics of a helicopter-autopilot system by means of simulation p 216 A83-23222

TORNOW, J. D.

Oceanic Area System Improvement Study (OASIS) Volume 7 North Atlantic region flight cost model results [FAA-EM-81-17-VOL-7] p 201 N83-16319

Oceanic Area System Improvement Study (OASIS) Volume 10 North Atlantic, Central East Pacific, and Caribbean regions aviation traffic forecasts [FAA-EM-81-17-VOL-10] p 201 N83-16322

TRISCHKA, J. W.

Computer-enhanced analysis of a jet in a cross stream p 228 A83-19804

TYLER, J.

Airport noise: Land-use compatibility by the year 2000 [PB82-259151] p 220 N83-16359

U

UHUAD, G. C.

Wind tunnel investigation of the transonic aerodynamic characteristics of forward swept wings p 190 A83-22153

UNGER, A.

Theoretical stiffness matrix correction by using static test results p 229 A83-21007

URBAN, C. H.

Equivalency evaluation of firefighting agents and minimum requirements at US Air Force airfields [FAA-CT-82-109] p 198 N83-17524

URBAN, L. J.

Distributed micro-processor applications to guidance and control systems [AGARD-AR-178] p 236 N83-18295

UVAROV, V. A.

Errors in the experimental determination of the parameters of supersonic combustion ramjet engines p 211 A83-22653

V

VAGT, J.-D.

A wind tunnel for unsteady turbulent shear flows - Design and flow calculation p 218 A83-19664

VAUGHAN, O. H., JR.

Observations of optical lightning emissions from above thunderstorms using U-2 aircraft p 234 A83-22703

VENABLES, J. D.

Effect of moisture on adhesively bonded titanium structures p 222 A83-20442

VETTES, B.

Studies on an acceleration platform and at the time of a simulated crash of helicopter antirush seats p 197 A83-22976

VIGNEVIC, N. P.

CTOL, STOAL, V/STOL - An operational comparison for forward deployed CVNs p 196 A83-22157

VOLOSHCHENKO, O. V.

The effect of the nonuniformity of supersonic flow with shocks on friction and heat transfer in the channel of a hypersonic ramjet engine p 211 A83-22654

VONNEGUT, B.

Observations of optical lightning emissions from above thunderstorms using U-2 aircraft p 234 A83-22703

VRANOS, A.

Experimental study of the thermal stability of hydrocarbon fuels [NASA-CR-168027] p 228 N83-17728

VUILLET

Methods used at Aerospatiale for calculating the loads on a rotor and experimental cross checks p 194 N83-17486

W

WANG, K. Y.

Oceanic Area System Improvement Study (OASIS) Volume 9 Flight cost model description [FAA-EM-81-17-VOL-9] p 201 N83-16321

WANG, Y. C.

Radio navigation and airplane navigation [AD-A120595] p 202 N83-16325

WANG, Y. S.

Theoretical and experimental evaluation of transmission loss of cylinders p 237 A83-19808

WANHILL, R. J. H.

Fatigue threshold and short crack significance for aircraft [NLR-MP-82007-U] p 234 N83-17902

Creep and fatigue interactions in a nickel base superalloy [NLR-MP-82003-U] p 234 N83-17903

WANNER, J. C.

Flying and design of aircraft [RAE-TRANS-2070] p 205 N83-16326

WARREN, B.

USAF ground fiber optic development program p 228 A83-19711

WARWICK, T.

Setting design goals for advanced propulsion systems [AIAA PAPER 81-1505] p 211 A83-22154

WASSERSTROM, E.

Numerical calculations of nonlinear aerodynamics of wing-body configurations p 189 A83-21022

WATANABE, A.

General purpose flight simulation program (FSPK-1) Part 1: Contents of the program [NAL-TR-702] p 207 N83-17529

WATANABE, K.

Numerical calculations for performances of propellers in a static-state by vortex theory accounting of slipstream deformation and their comparisons with experiments p 189 A83-22072

WEEKS, T. M.

Wind tunnel investigation of the transonic aerodynamic characteristics of forward swept wings p 190 A83-22153

WEICHERT, M.

Water injection into compressors of gas turbines for power increase and reduction of NOX emission [BMFT-FB-T-82-075] p 233 N83-16765

WEINGARTEN, N. C.

In-flight investigation of large airplane flying qualities for approach and landing [AD-A120202] p 206 N83-16332

WEINS, D.

Curved lifting-line theory for thin planar wings p 189 A83-21024

Z

- WEISLOGEL, G. S.**
Statistical summary Study to determine the IFR operational profile of the general aviation single pilot
[NASA-CR-165805] p 198 N83-17523
- WEISS, D. M.**
The A-7E software requirements document: Three years of change data
[AD-A121602] p 237 N83-18322
- WEISS, J. P.**
Design considerations for the construction of a Shenff wing in composite materials
[BU-280] p 206 N83-16337
- WENTZ, W. H., JR.**
Wind tunnel force and pressure tests
[NASA-CR-3439] p 190 N83-16287
- WESTON, A. R.**
An on-board near-optimal climb-dash energy management
[NASA-CR-169755] p 205 N83-16329
- WETTLAUER, B. M.**
The aerodynamic performance of several flow control devices for internal flow systems
[NASA-TP-1972] p 221 N83-17560
- WHITE, D. J.**
Damage tolerance assessment of the A-7D aircraft structure
p 204 A83-21771
- WHITNEY, W. J.**
Aerodynamic effect of a honeycomb rotor tip shroud on a 50 8-centimeter-tip-diameter core turbine
[NASA-TP-2112] p 215 N83-17547
- WIBERLEY, S. E.**
Composite structural materials
[NASA-CR-169859] p 226 N83-17597
- WIGHTMAN, D. C.**
Applications of simulator freeze to carrier glideslope tracking instruction
[AD-A118862] p 220 N83-16356
- WILLIAMS, M. C.**
Anti-misting additives for jet fuels
[NASA-CR-169751] p 225 N83-16417
Viscometric and misting properties of polymer-modified fuel
[NASA-CR-169750] p 226 N83-16543
- WILLIAMS, R. C.**
Turbopan blade stresses induced by the flow distortion of a VTOL inlet at high angles of attack
[NASA-TM-82963] p 194 N83-17509
- WINTER, H.**
Gyroscopic instruments and their application to flight testing
[AGARD-AG-160-VOL-15] p 233 N83-17855
- WINTERBONE, D. E.**
Design of an integrated control system for a supersonic aircraft power plant
p 212 A83-23175
- WOLF, P.**
Aids to decision making in airport planning
[REPT-34] p 221 N83-17562
- WOLOCK, I.**
The effect of loading rates, temperature and moisture on the fracture toughness of polycarbonate
p 223 A83-20497
- WOODCOCK, R. J.**
Criteria for handling qualities of military aircraft
[AGARD-AR-186] p 217 N83-17555
- WU, C. M.**
Helicopter fin effectiveness
[BU-271] p 206 N83-16336
- ZABIEREK, D. W.**
Evaluation of air-cooled Si3N4 vanes
p 224 A83-22263
- ZALMANOVICH, A.**
Theoretical stiffness matrix correction by using static test results
p 229 A83-21007
- ZARETSKY, E. V.**
Advances in high-speed rolling-element bearings
p 231 A83-22319
- ZHDANOV, V. T.**
Theory and design of flight-vehicle engines
p 211 A83-22651
- ZOLA, C. L.**
Conventional profile coaxial jet noise prediction
p 237 A83-22128

Y

- YAMAMOTO, M.**
Nonlinear forced oscillations of a rotating shaft carrying an unsymmetrical rotor at the major critical speed
p 228 A83-20288
- YAMAMOTO, T.**
Nonlinear forced oscillations of a rotating shaft carrying an unsymmetrical rotor at the major critical speed
p 228 A83-20288
- YOUNG, C.**
Development of the vortex ring wake model and its influence on the prediction of rotor loads
p 194 N83-17481
- YOUNG, J. C.**
Results from tests, with van-mounted sensor, of magnetic leader cable for aircraft guidance during roll-out and turnoff
[NASA-TP-2092] p 209 N83-16338
- YOUNGSON, G. G.**
A transonic quasi-3D analysis for gas turbine engines including split-flow capability for turbofans
p 190 A83-22647

MAY 1983

C-1

L

- Evaluation of retroreflective pavement markers for precision and nonprecision runways
[FAA-CT-82-112] p 220 N83-17558
- Evaluation of supplemental lights for caution bars
[FAA-CT-82-119] p 220 N83-17559
- Mode S baseline radar tracking
[FAA-RD-82-53] p 233 N83-17770
- Federal Aviation Administration, Washington, D.C.**
- Maintenance of airport visual aid facilities: Advisory circular
[AC-150-5340-26] p 219 N83-16352
- An overview of the DOT/FAA aviation energy conservation policy p 235 N83-17460
- Flow Application Research, Fremont, Calif.**
- Turbine engine fuel conservation by fan and compressor profile control p 213 N83-17467

G

- Garrett Turbine Engine Co., Phoenix, Ariz.**
- A method to estimate weight and dimensions of small aircraft propulsion gas turbine engines: User's guide
[NASA-CR-168049] p 213 N83-16343
- Computer program to predict noise of general aviation aircraft: User's guide
[NASA-CR-168050] p 238 N83-17242
- General Dynamics Corp., Fort Worth, Tex.**
- Development of aerodynamic prediction methods for irregular planform wings
[NASA-CR-3664] p 195 N83-17515
- Advanced Ultra-Violet (UV) aircraft fire detection system
Volume 1. System description and flight test
[AD-A121253] p 198 N83-17526
- General Electric Co., Cincinnati, Ohio.**
- Energy efficient engine Fan test hardware detailed design report
[NASA-CR-165148] p 212 N83-16341
- The CF6 engine performance improvement
[NASA-CR-165612] p 212 N83-16342
- Material characterization Part B. Mechanical properties of 2 metal matrix composite materials
[AD-A119829] p 225 N83-16402
- Equivalent damage A critical assessment
[NASA-CR-167874] p 214 N83-17542
- Beaming fatigue investigation 3
[NASA-CR-168029] p 233 N83-17880
- General Electric Co., Evendale, Ohio.**
- Summary report for CF6 jet engine, diagnostics program
[NASA-CR-165582] p 214 N83-17539
- Goodyear Aerospace Corp., Akron, Ohio.**
- Dynamic stability of a buoyant quad-rotor aircraft
p 216 A83-22160
- Grumman Aerospace Corp., Bethpage, N.Y.**
- Manufacturing processes for aeronautical structures
p 227 N83-17620
- Specific examples of aerospace applications of composites p 227 N83-17621

H

- Honeywell, Inc., Lexington, Mass.**
- Thermal infrared pushbroom imagery acquisition and processing p 209 A83-22841

I

- Ideal Research, Inc., Rockville, Md.**
- Microwave Ice Accretion Measurement Instrument /MIAMI/ p 208 A83-22163
- Institut de Mecanique des Fluides de Toulouse (France).**
- Prediction and experimental verification of the velocity fields of a rotor during hovering p 193 N83-17477
- Institute of Gas Technology, Chicago, Ill.**
- Coal gasification for stationary gas-turbine applications
[DE82-902135] p 226 N83-16553

J

- Joint Publications Research Service, Arlington, Va.**
- ATR 42 will have ultramodern, innovative cockpit, avionics p 208 N83-17759

K

- Kentron Technical Center, Hampton, Va.**
- Comparison of forward flight effects theory of A Michalke and U Michel with measured data
[NASA-CR-3665] p 238 N83-17239

- Lancaster Analytics, North Canton, Ohio.**
- Naval Airship Program for Sizing and Performance (NAPSAP), computer program development Program update number 2 p 191 N83-16293
- Limbach-Motorenbau, Koenigswinter (West Germany).**
- Vibration-free internal combustion engine for general aviation
[BMFT-FB-W-82-016] p 213 N83-16347
- Lockheed-California Co., Burbank.**
- Demonstration of reparability and repair quality on graphite/epoxy structural subelements p 186 A83-20485
- Repair techniques for graphite/epoxy structures for commercial transport applications
[NASA-CR-159056] p 225 N83-16397
- Lockheed-Georgia Co., Marietta.**
- Program for establishing long-time flight service performance of composite materials in the center wing structure of C-130 aircraft. Phase 5 Flight service and inspection
[NASA-CR-165770] p 227 N83-17600
- Lufthansa German Airlines, Cologne (West Germany).**
- Slidestop indication system p 210 N83-17466

M

- Massachusetts Inst. of Tech., Cambridge.**
- An optimal control approach to the design of moving flight simulators p 218 A83-19949
- Messerschmitt-Boelkow-Blohm G.m.b.H., Hamburg (West Germany).**
- Service operation of a CFRP window frame in short fiber pressing
[BMFT-FB-W-82-021] p 233 N83-17749
- Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (West Germany).**
- Calculation of 3D unsteady transonic flow around rotor blades p 193 N83-17474
- Studies on blade-to-blade and rotor-fuselage-tail interferences p 193 N83-17479
- Messerschmitt-Boelkow-Blohm G.m.b.H., Ottobrunn (West Germany).**
- Survey of active and passive means to reduce rotorcraft vibrations
[MBB-UD-350] p 206 N83-16335
- Transonic effects on helicopter rotor blades
[MBB-349-81-O-E] p 195 N83-17520
- Studies on blade-to-blade and rotor-fuselage-tail interferences
[MBB-351-82-O-E] p 195 N83-17521
- Force initiations in helicopter rotor blades, wind channel fans and wind turbines
[MBB-UD-356-82-O] p 196 N83-17522
- The use of helicopters in Europe Analysis and prospects
[MBB-UD-359/82-O] p 207 N83-17533
- Minnesota Univ., Minneapolis.**
- Eigenpace techniques for active flutter suppression
[NASA-CR-169858] p 217 N83-17556
- Mitre Corp., McLean, Va.**
- Conflict monitoring analysis of parallel opposite direction routes, volume 2
[AD-A120187] p 202 N83-16323

N

- National Aeronautics and Space Administration, Washington, D. C.**
- The calculation of separated flow at helicopter bodies
[NASA-TM-76715] p 191 N83-16291
- The half-model technique in the wind tunnel and its employment in the development of the airbus family
[NASA-TM-76970] p 205 N83-16328
- National Aerospace Lab., Amsterdam (Netherlands).**
- The on-board computer system for the F29 prototype flight test
[NLR-MP-81034-U] p 209 N83-16339
- The F29 flight test instrumentation and data processing system An overview of requirements, design and organization
[NLR-MP-81035-U] p 209 N83-16340
- A control model for maneuvering flight for application to a computer flight testing program
[NLR-MP-81046-U] p 207 N83-17531
- Predicted and measured landing gear loads for the NF-5 aircraft taxiing over a bumpy runway
[NLR-MP-82008-U] p 207 N83-17532
- Erosion of protective compressor coatings
[NLR-MP-87067-U] p 228 N83-17716

- Fatigue threshold and short crack significance for aircraft
[NLR-MP-82007-U] p 234 N83-17902
- Creep and fatigue interactions in a nickel base superalloy
[NLR-MP-82003-U] p 234 N83-17903
- Computers in avionics systems
[NLR-MP-81063-U] p 236 N83-18291
- National Aerospace Lab., Tokyo (Japan).**
- Flight simulation test of National Aerospace Laboratory STOL-research-aircraft. Part 1. STOL configuration
[NAL-TR-713-PT-1] p 207 N83-17528
- General purpose flight simulation program (FSPK-1) Part 1 Contents of the program
[NAL-TR-702] p 207 N83-17529
- The estimation method on flutter boundary from subcritical random responses due to air turbulences Problems of test procedures and data analysis
[NAL-TR-718] p 217 N83-17554
- National Transportation Safety Board, Washington, D. C.**
- Aircraft accident report: Sun West Airlines Flight 104, Piper PA-31-350(T-1020), N41070, Durango-LaPlata County Airport, Durango, Colorado, December 31, 1981 (PB82-910413) p 197 N83-16309
- Naval Postgraduate School, Monterey, Calif.**
- Evaluation of helicopter pilot's attitude control using a simulated head-up display in a simulated helicopter cockpit
[AD-A119570] p 219 N83-16355
- An investigation of the effectiveness of smoke suppressant fuel additives for turbojet applications
[AD-A121228] p 215 N83-17549
- Naval Research Lab., Washington, D. C.**
- The A-7E software requirements document. Three years of change data
[AD-A121602] p 237 N83-18322
- Naval Submarine Medical Research Lab., Groton, Conn.**
- Desirable characteristics of underwater lights for helicopter escape hatches
[AD-A120331] p 197 N83-16310
- Desirable characteristics of underwater lights for helicopter escape hatches
[AD-A120510] p 198 N83-16312
- Neilson Engineering and Research, Inc., Mountain View, Calif.**
- Blade erosion effects on aircraft-engine compressor performance
[DE82-021791] p 213 N83-16346
- Development of a procedure for calculating the effects of airfoil erosion on aircraft engine compressor performance p 213 N83-17457
- New Mexico Inst. of Mining and Technology, Socorro.**
- Observations of optical lightning emissions from above thunderstorms using U-2 aircraft p 234 A83-22703
- North Carolina State Univ., Raleigh.**
- A study of optimum cowl shapes and flow port locations for minimum drag with effective engine cooling, volume 1
[NASA-CR-159379] p 191 N83-16288
- A study of optimum cowl shapes and flow port locations for minimum drag with effective engine cooling, volume 2
[NASA-CR-159380] p 191 N83-16289
- A study of real-time computer graphic display technology for aeronautical applications
[NASA-CR-169828] p 236 N83-18307
- Northrop Corp., Hawthorne, Calif.**
- Demonstration of reparability and repair quality on graphite/epoxy structural subelements p 186 A83-20485
- Northwest Airlines, Inc., Minneapolis, Minn.**
- Fuel conservation techniques in jet transport aircraft operations p 188 N83-17463
- National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.**
- Radiation from a double layer jet p 237 A83-20364
- Automation of on-board flightpath management
p 215 A83-21002
- Dynamic structural aeroelastic stability testing of the XV-15 tilt rotor research aircraft
[NASA-TM-84293] p 216 N83-16349
- The application of parameter estimation to flight measurements to obtain lateral-directional stability derivatives of an augmented jet-flap STOL airplane
[NASA-TP-2033] p 216 N83-16350
- Optimal short-range trajectories for helicopters
[NASA-TM-84303] p 187 N83-17451
- The influence of handling qualities, crashworthiness and other engineering factors on aircraft safety p 198 N83-17493
- The engineering investigation of aircraft accidents p 188 N83-17497

- Minimum-fuel turning climbout and descent guidance of transport jets
[NASA-TM-84289] p 217 N83-17552
- The aerodynamic performance of several flow control devices for internal flow systems
[NASA-TP-1972] p 221 N83-17560
- National Aeronautics and Space Administration.**
Langley Research Center, Hampton, Va.
Screch suppression in supersonic jets
p 237 N83-19814
- Flight test results of an active flutter suppression system
p 216 N83-22164
- Fiber optic wavelength multiplexing for civil aviation applications
p 208 N83-22492
- Low-speed aerodynamic characteristics of a 17-percent-thick medium speed airfoil designed for general aviation applications
[NASA-TP-1786] p 191 N83-16290
- Results from tests, with van-mounted sensor, of magnetic leader cable for aircraft guidance during roll-out and turnoff
[NASA-TP-2092] p 209 N83-16338
- Multiple-event airplane noise annoyance
[NASA-TP-2101] p 234 N83-16951
- Sound shield
[NASA-CASE-LAR-12883-1] p 237 N83-17235
- Effect of external stores on the stability and control characteristics of a delta wing fighter model at Mach numbers from 0.60 to 2.01
[NASA-TM-84596] p 194 N83-17508
- The minimization of pylon-mounted store effects on air combat capability
[NASA-TM-84597] p 195 N83-17510
- Performance of high-altitude, long-endurance, turboprop airplanes using conventional or cryogenic fuels
[NASA-TM-84534] p 207 N83-17530
- Planning fuel-conservative descents with or without time constraints using a small programmable calculator
Algorithm development and flight test results
[NASA-TP-2085] p 210 N83-17535
- Analysis of oscillatory motion of a light airplane at high values of lift coefficient
[NASA-TM-84563] p 216 N83-17550
- Structural testing for static failure, flutter and other scary things
[NASA-TM-84606] p 234 N83-17899
- National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.**
Effect of broad properties fuel on injector performance in a reverse flow combustor
[AIAA PAPER 83-0154] p 210 A83-21079
- An analytical and experimental comparison of the flow field of an advanced swept turboprop
[AIAA PAPER 83-0189] p 189 A83-21080
- Conventional profile coaxial jet noise prediction
p 237 A83-22128
- Advances in high-speed rolling-element bearings
p 231 A83-22319
- Fiber optics for aircraft engine/inlet control
p 211 A83-22494
- Analysis of a MIL-L-27502 lubricant from a gas-turbine engine test by size-exclusion chromatography
[NASA-TP-2063] p 226 N83-16528
- Rolling-element fatigue life of AMS 5900 balls
[NASA-TP-2080] p 232 N83-16758
- Turboprop blade stresses induced by the flow distortion of a VTOL inlet at high angles of attack
[NASA-TM-82963] p 194 N83-17509
- Aerodynamic effect of a honeycomb rotor tip shroud on a 50.8-centimeter-tip-diameter core turbine
[NASA-TP-2112] p 215 N83-17547
- Coating with overlay metallic-cermet alloy systems
[NASA-CASE-LEW-13639-2] p 227 N83-17683
- Aircraft turbofan noise
[NASA-TM-83317] p 239 N83-18405
- National Aeronautics and Space Administration.**
Lyndon B. Johnson Space Center, Houston, Tex.
Program to compute the positions of the aircraft and of the aircraft sensor footprints
[E83-10139] p 234 N83-16814
- National Aeronautics and Space Administration.**
Marshall Space Flight Center, Huntsville, Ala.
Observations of optical lightning emissions from above thunderstorms using U-2 aircraft
p 234 A83-22703
- Optical observations of unidirectional solidification in microgravity
[NASA-TP-2110] p 225 N83-16492
- O**
- Office of Science and Technology, Washington, D. C.**
Aeronautical research and technology policy Volume 1 Summary report p 187 N83-17452

- Office National d'Etudes et de Recherches Aérospatiales, Paris (France).**
Studies of aerofolds and blade tips for helicopters
p 193 N83-17473
- Aeroelastic equilibrium of an helicopter rotor with nonlinear aerodynamic forces
p 235 N83-17482
- Activities report of the French aerospace and research industry
p 221 N83-17564
- Ohio State Univ., Columbus.**
Statistical summary Study to determine the IFR operational profile of the general aviation single pilot
[NASA-CR-165805] p 198 N83-17523
- Ohio Univ., Athens.**
Cockpit weather radar display demonstrator and ground-to-air sfence telemetry system
[NASA-CR-169830] p 210 N83-17534
- Operations Research, Inc., Silver Spring, Md.**
Airport community soundproofing and relocation study
[PB82-259144] p 220 N83-16358
- Research and technology program perspectives for general aviation and commuter aircraft
[NASA-CR-169875] p 187 N83-17454

P

- Pacific Northwest Lab., Richland, Wash.**
Sputtered ceramic coatings and sealing layers
[DE82-005225] p 226 N83-16531
- Composite design of an advanced airborne monitoring system
[DE82-006980] p 235 N83-18106
- Peat, Marwick, Mitchell and Co., San Francisco, Calif.**
Aircraft towing feasibility study
p 207 N83-17458
- Pennsylvania State Univ., University Park.**
Blade loading and rotation effects on compressor rotor wake near end walls
p 190 A83-22138
- Performance Measurement Associates, Inc., Vienna, Va.**
Performance measures for aircraft carrier landings as a function of aircraft dynamics
[AD-A120473] p 206 N83-16334
- Pisa Univ. (Italy).**
Rotor-fuselage interference on engine internal aerodynamics in maneuvering high-speed rotorcraft
p 193 N83-17480
- Pratt and Whitney Aircraft Group, East Hartford, Conn.**
The JT8D and JT9D engine component improvement Performance improvement program
[NASA-CR-167965] p 214 N83-17543
- The JT9D Jet Engine Diagnostics Program
[NASA-CR-167966] p 214 N83-17544
- Pratt and Whitney Aircraft Group, West Palm Beach, Fla.**
Flight evaluation of an engine static pressure noseprobe in an F-15 airplane
[NASA-CR-163109] p 214 N83-17546
- Prins Maurits Lab. TNO, Rijswijk (Netherlands).**
General basic concepts for a trajectory simulation of a guided missile
[PML-1981-36] p 221 N83-17574
- Purdue Univ., Lafayette, Ind.**
Theoretical and experimental evaluation of transmission loss of cylinders
p 237 A83-19808
- An analytical and experimental comparison of the flow field of an advanced swept turboprop
[AIAA PAPER 83-0189] p 189 A83-21080

R

- Rensselaer Polytechnic Inst., Troy, N. Y.**
Composite structural materials
[NASA-CR-169859] p 226 N83-17597
- Research Inst. of National Defence, Stockholm (Sweden).**
A limited study of thrust vector control with guide vanes and jet rudder
[FOA-C-20455-E3] p 221 N83-16386
- Royal Aircraft Establishment, Bedford (England).**
An appraisal of rotor blade-tip vortex interaction and wake geometry from flight measurements
p 194 N83-17488
- Royal Aircraft Establishment, Farnborough (England).**
Finite difference calculation of an inviscid transonic flow over oscillating airfoils
[RAE-TRANS-2087] p 191 N83-16292
- Flying and design of aircraft
[RAE-TRANS-2070] p 205 N83-16326
- Development of the vortex ring wake model and its influence on the prediction of rotor loads
p 194 N83-17481
- Development of the precision approach path indicator light unit
[RAE-TM-FS(B)-483] p 202 N83-17527

- The electrical properties of carbon fibre composites
p 227 N83-17618
- S**
- Sandia Labs., Albuquerque, N. Mex.**
Sandia Aircraft Crashfire Facility
[DE82-004297] p 198 N83-16313
- School of Aerospace Medicine, Brooks AFB, Tex.**
An overview of human factors in aircraft accidents and investigative techniques
p 198 N83-17491
- Sikorsky Aircraft, Stratford, Conn.**
Predesign study for a modern 4-bladed rotor for the RSRA
[NASA-CR-166155] p 206 N83-16331
- Review of rotor loads prediction methods
p 194 N83-17484
- Societe Nationale Industrielle Aerospatiale, Marseille (France).**
Methods used at Aerospatiale for calculating the loads on a rotor and experimental cross checks
p 194 N83-17486
- Stanford Univ., Calif.**
Effects of flight on noise radiated from convected ring sources in coaxial dual flow Part 2 The noise from heated jets
[NASA-CR-169736] p 238 N83-17237
- Effects of noise radiated from convected ring sources in coaxial dual flow Part 1 The noise from unheated jets
[NASA-CR-169737] p 238 N83-17238
- State Univ. of New York, Albany.**
Observations of optical lightning emissions from above thunderstorms using U-2 aircraft
p 234 A83-22703
- Stuttgart Univ. (West Germany).**
An interactive system for transformation of known measures long internal surface of cylinders model for shafts
[ISD-294] p 233 N83-17748
- Systems Control, Inc., West Palm Beach, Fla.**
The analysis of integrated fuel efficient, low noise procedures in lax terminal area operations
p 202 N83-17459
- SRI International Corp., Menlo Park, Calif.**
The software-implemented fault tolerance /SIFT/ approach to fault tolerant computing
p 235 A83-22825
- Oceanic Area System Improvement Study (OASIS) Volume 1 Executive summary and improvement alternatives development and analysis**
[FAA-EM-81-17-VOL-1] p 200 N83-16314
- Oceanic Area System Improvement Study (OASIS) Volume 2 North Atlantic region air traffic services system description**
[FAA-EM-81-17-VOL-2] p 201 N83-16315
- Oceanic Area System Improvement Study (OASIS) Volume 3 Central East Pacific region air traffic services system description**
[FAA-EM-81-17-VOL-3] p 201 N83-16316
- Oceanic Area System Improvement Study (OASIS) Volume 4 Caribbean region air traffic services system description**
[FAA-EM-81-17-VOL-4] p 201 N83-16317
- Oceanic Area System Improvement Study (OASIS) Volume 5 North Atlantic, Central East Pacific, and Caribbean regions communication systems description**
[FAA-EM-81-17-VOL-5] p 201 N83-16318
- Oceanic Area System Improvement Study (OASIS) Volume 6 North Atlantic region flight cost model results**
[FAA-EM-81-17-VOL-6] p 201 N83-16319
- Oceanic Area System Improvement Study (OASIS) Volume 7 North Atlantic region flight cost model results**
[FAA-EM-81-17-VOL-7] p 201 N83-16320
- Oceanic Area System Improvement Study (OASIS) Volume 8 Central East Pacific region flight cost model results**
[FAA-EM-81-17-VOL-8] p 201 N83-16320
- Oceanic Area System Improvement Study (OASIS) Volume 9 Flight cost model description**
[FAA-EM-81-17-VOL-9] p 201 N83-16321
- Oceanic Area System Improvement Study (OASIS) Volume 10 North Atlantic, Central East Pacific, and Caribbean regions aviation traffic forecasts**
[FAA-EM-81-17-VOL-10] p 201 N83-16322
- T**
- Technion - Israel Inst. of Tech., Haifa.**
An optimal control approach to the design of moving flight simulators
p 218 A83-19949
- Technische Hochschule, Aachen (West Germany).**
Aids to decision making in airport planning
[REPT-34] p 221 N83-17562
- Technische Univ., Berlin (West Germany).**
Water injection into compressors of gas turbines for power increase and reduction of NOX emission
[BMFT-FB-T-82-075] p 233 N83-16765

Textron Bell Helicopter, Fort Worth, Tex.

CORPORATE SOURCE

Textron Bell Helicopter, Fort Worth, Tex.

Benefits assessment of active control technology and related cockpit technology for rotorcraft
[NASA-CR-166406] p 217 N83-17553

Tuskegee Inst., Ala.

Three computer based aids to maintenance scheduling
[AD-A120351] p 187 N83-16280

U

United Air Lines, Inc., Denver, Colo.

Flight preparation and planning p 188 N83-17462
Computerized engine and airplane performance monitoring programs p 188 N83-17465

United Technologies Research Center, East Hartford, Conn.

Experimental study of the thermal stability of hydrocarbon fuels
[NASA-CR-168027] p 228 N83-17728

V

Virginia Polytechnic Inst. and State Univ., Blacksburg.

Subsonic steady and unsteady aerodynamic loads on missiles and aircraft
[NASA-CR-169749] p 190 N83-16284

An on-board near-optimal climb-dash energy management
[NASA-CR-169755] p 205 N83-16329

Von Karman Inst. for Fluid Dynamics,

Rhode-Saint-Genese (Belgium).

Laser-Doppler velocimeter (LDV) measurements of the velocity field of a leading edge vortex over a delta wing before and after vortex breakdown

[VKI-TN-142] p 192 N83-16300

The wake of a sideslipping wing in low speed flow
[VKI-TN-143] p 192 N83-16301

W

Westland Aircraft Ltd., Hayes (England).

Representation of airfoil behaviour
p 192 N83-17472

Wichita State Univ., Kans.

Wind tunnel force and pressure tests
[NASA-CR-3439] p 190 N83-16287

Wyle Labs., Inc., El Segundo, Calif.

A pilot study of human response to general aviation aircraft noise
[NASA-CR-166053] p 238 N83-18404

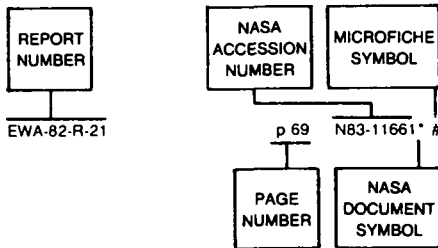
MAY 1983

REPORT NUMBER INDEX

AERONAUTICAL ENGINEERING / A Continuing Bibliography (Supplement 161)

MAY 1983

Typical Report Number Index Listing



Listings in this index are arranged alphanumerically by report number. The page number indicates the page on which the citation is located. The accession number denotes the number by which the citation is identified. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

A-8816	p 221	N83-17560* #	AGARD-CP-334	p 188	N83-17470 #	FAA-EM-81-17-VOL-1	p 200	N83-16314 #
A-8977	p 216	N83-16350* #	AGARD-LS-124	p 227	N83-17609 #	FAA-EM-81-17-VOL-2	p 201	N83-16315 #
A-9067	p 217	N83-17552* #	AGARD-LS-125	p 188	N83-17490 #	FAA-EM-81-17-VOL-3	p 201	N83-16316 #
A-9081	p 216	N83-16349* #	AIAA PAPER 81-1505	p 211	A83-22154 #	FAA-EM-81-17-VOL-4	p 201	N83-16317 #
A-9132	p 187	N83-17451* #	AIAA PAPER 81-2039	p 237	A83-19813* #	FAA-EM-81-17-VOL-5	p 201	N83-16318 #
AC-150-5340-26	p 219	N83-16352 #	AIAA PAPER 83-0154	p 210	A83-21079* #	FAA-EM-81-17-VOL-6	p 201	N83-16319 #
ACEE-01-FR-2995	p 216	N83-17551* #	AIAA PAPER 83-0189	p 189	A83-21080* #	FAA-EM-81-17-VOL-7	p 201	N83-16320 #
AD-A107106	p 188	N83-17455 #	AMRL-TR-75-50-VOL-150	p 238	N83-17246 #	FAA-EM-81-17-VOL-8	p 201	N83-16321 #
AD-A118862	p 220	N83-16356 #	AMRL-TR-75-50-VOL-152	p 238	N83-17247 #	FAA-EM-81-17-VOL-9	p 201	N83-16322 #
AD-A119570	p 219	N83-16355 #	AR-002323	p 205	N83-16327 #	FAA-EM-82-23-VOL-2	p 202	N83-16323 #
AD-A119828	p 232	N83-16760 #	ARL-MECH-ENG-NOTE-388	p 205	N83-16327 #	FAA-RD-82-53	p 233	N83-17770 #
AD-A119829	p 225	N83-16402 #	ASD-TR-82-5008	p 232	N83-16760 #	FAA-RD-82-79	p 220	N83-17559 #
AD-A119839	p 225	N83-16401 #	ASRL-TR-194-3	p 195	N83-17518 #	FAA-RD-82-83	p 220	N83-17558 #
AD-A120009	p 232	N83-16566 #	AVRADCOM-TR-81-A-2	p 221	N83-17560* #	FFA-TN-1982-07	p 195	N83-17518 #
AD-A120187	p 202	N83-16323 #	B-8406	p 236	N83-18304* #	FOA-C-20455-E3	p 221	N83-16386 #
AD-A120202	p 206	N83-16332 #	BMFT-FB-T-82-075	p 233	N83-16765 #	FR-14915	p 214	N83-17546* #
AD-A120255	p 197	N83-16311 #	BMFT-FB-W-82-016	p 213	N83-16347 #	FTD-ID(RS)T-0870-82	p 202	N83-16325 #
AD-A120331	p 197	N83-16310 #	BMFT-FB-W-82-021	p 233	N83-17749 #	GARRETT-21-4270-1	p 213	N83-16343* #
AD-A120351	p 187	N83-16280 #	BR84981	p 202	N83-17527 #	GARRETT-21-4270-2	p 238	N83-17242* #
AD-A120470	p 213	N83-16345 #	BR85535	p 205	N83-16326 #	GE-R82AEB304	p 233	N83-17880* #
AD-A120473	p 206	N83-16334 #	BR86199	p 191	N83-16292 #	ISBN-92-835-0319-7	p 188	N83-17490 #
AD-A120508	p 238	N83-17246 #	BU-271	p 206	N83-16336 #	ISBN-92-835-0320-1	p 188	N83-17470 #
AD-A120509	p 238	N83-17247 #	BU-273	p 192	N83-16303 #	ISBN-92-835-1428-9	p 236	N83-18295 #
AD-A120510	p 198	N83-16312 #	BU-276	p 192	N83-16305 #	ISBN-92-835-1433-5	p 233	N83-17855 #
AD-A120595	p 202	N83-16325 #	BU-279	p 192	N83-16306 #	ISBN-92-835-1436-X	p 227	N83-17609 #
AD-A120627	p 187	N83-16281 #	BU-280	p 206	N83-16337 #	ISBN-92-835-1437-8	p 217	N83-17555 #
AD-A120830	p 191	N83-16293 #	C-6645-F-5	p 206	N83-16332 #	ISD-294	p 233	N83-17748 #
AD-A121228	p 215	N83-17549 #	CETIM-12-E-12-0	p 226	N83-16538 #	ISSN-0170-1339	p 213	N83-16347 #
AD-A121253	p 198	N83-17526 #	CONF-810885-3	p 226	N83-16531 #	ISSN-0170-1339	p 233	N83-17749 #
AD-A121602	p 237	N83-18322 #	CONF-8110124-2	p 198	N83-16313 #	ISSN-0170-6071	p 233	N83-17748 #
AD-E000506	p 237	N83-18322 #	CONF-811220-1	p 226	N83-16553 #	ISSN-0340-7608	p 233	N83-16765 #
AFAMRL-TR-82-51	p 197	N83-16311 #	CONF-820117-1	p 235	N83-18106 #	ISSN-0389-4010	p 207	N83-17528 #
AFHRL-TP-82-24	p 187	N83-16281 #	CW-WR-81-022F	p 214	N83-17545* #	ISSN-0389-4010	p 207	N83-17529 #
AFHRL-TR-82-3	p 220	N83-16356 #	DE82-004297	p 198	N83-16313 #	ISSN-0389-4010	p 217	N83-17554 #
AFOSR-82-0874TR	p 187	N83-16280 #	DE82-005225	p 226	N83-16531 #	JSC-18574	p 234	N83-16814* #
AFOSR-82-0911TR	p 213	N83-16345 #	DE82-006980	p 235	N83-18106 #	L-13900	p 191	N83-16290* #
AFWAL-TR-81-3118	p 206	N83-16332 #	DE82-021791	p 213	N83-16346 #	L-15122	p 216	N83-17550* #
AFWAL-TR-82-2042-VOL-2	p 225	N83-16402 #	DE82-902135	p 226	N83-16553 #	L-15389	p 210	N83-17535* #
AFWAL-TR-82-2043	p 225	N83-16401 #	DFVLR-FB-82-22	p 195	N83-17517 #	L-15482	p 209	N83-16338* #
AFWAL-TR-82-2062-VOL-1	p 198	N83-17526 #	DGLR-PAPER-81-118	p 205	N83-16328* #	L-15517	p 234	N83-16951* #
AGARD-AG-160-VOL-15	p 233	N83-17855 #	DOE/CS-50095/T2	p 213	N83-16346 #	LA-TR-4	p 191	N83-16293 #
AGARD-AR-178	p 236	N83-18295 #	D6-51088	p 236	N83-18304* #	LG81340198	p 227	N83-17600* #
AGARD-AR-186	p 217	N83-17555 #	E-1075	p 226	N83-16528* #	MBB-UD-350	p 206	N83-16335 #
			E-1190	p 232	N83-16758* #	MBB-UD-356-82-O	p 196	N83-17522 #
			E-1261	p 215	N83-17547* #	MBB-UD-359/82-O	p 207	N83-17533 #
			E-1380	p 194	N83-17509* #	MBB-349-81-O-E	p 195	N83-17520 #
			E-1510	p 239	N83-18405* #	MBB-351-82-O-E	p 195	N83-17521 #
			EPA-550/9-82-343	p 220	N83-16358 #	MTR-82W00114-VOL-2	p 202	N83-16323 #
			EPA-550/9-82-344	p 220	N83-16359 #	NADC-81218-60	p 191	N83-16293 #
			E83-10139	p 234	N83-16814* #	NAL-TR-702	p 207	N83-17529 #
			FAA-CT-82-109	p 198	N83-17524 #	NAL-TR-713-PT-1	p 207	N83-17528 #
			FAA-CT-82-111	p 197	N83-16308 #	NAL-TR-718	p 217	N83-17554 #
			FAA-CT-82-112	p 220	N83-17558 #	NAS 1 15 76715	p 191	N83-16291* #
			FAA-CT-82-119	p 220	N83-17559 #	NAS 1 15 76970	p 205	N83-16328* #
			FAA-CT-82-43	p 233	N83-17770 #	NAS 1 15 82963	p 194	N83-17509* #
			FAA-EM-81-17-VOL-10	p 201	N83-16322 #	NAS 1 15 83317	p 239	N83-18405* #
						NAS 1 15 84289	p 217	N83-17552* #
						NAS 1 15 84293	p 216	N83-16349* #
						NAS 1 15 84303	p 187	N83-17451* #
						NAS 1 15 84534	p 207	N83-17530* #
						NAS 1 15 84563	p 216	N83-17550* #
						NAS 1 15 84596	p 194	N83-17508* #
						NAS 1 15 84597	p 195	N83-17510* #
						NAS 1 15 84606	p 234	N83-17899* #

REPORT

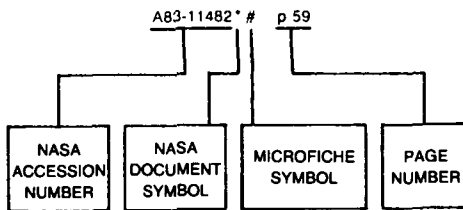
NAS 1.15:85199	p 234	N83-16814* #	NASA-TM-83317	p 239	N83-18405* #	US-PATENT-APPL-SN-267935	p 237	N83-17235* #
NAS 1.26 159056	p 225	N83-16397* #	NASA-TM-84289	p 217	N83-17552* #	US-PATENT-APPL-SN-456460	p 227	N83-17683* #
NAS 1.26 159252	p 216	N83-17551* #	NASA-TM-84293	p 216	N83-16349* #	US-PATENT-CLASS-73-147	p 237	N83-17235* #
NAS 1.26 159258	p 205	N83-16330* #	NASA-TM-84303	p 187	N83-17451* #	US-PATENT-4,363,237	p 237	N83-17235* #
NAS 1.26 159379	p 191	N83-16288* #	NASA-TM-84534	p 207	N83-17530* #	USAAVRADCOM-82-A-17	p 216	N83-16349* #
NAS 1.26 159380	p 191	N83-16289* #	NASA-TM-84563	p 216	N83-17550* #	VKI-TN-142	p 192	N83-16300 #
NAS 1.26 163109	p 214	N83-17546* #	NASA-TM-84596	p 194	N83-17508* #	VKI-TN-143	p 192	N83-16301 #
NAS 1.26 165148	p 212	N83-16341* #	NASA-TM-84597	p 195	N83-17510* #	WES/MP-GL-82-11	p 232	N83-16566 #
NAS 1.26 165399	p 214	N83-17545* #	NASA-TM-84606	p 234	N83-17899* #	WR-82-24	p 238	N83-18404* #
NAS 1.26 165582	p 214	N83-17539* #	NASA-TM-85199	p 234	N83-16814* #	WSU-AR-78-4	p 190	N83-16287* #
NAS 1.26 165612	p 212	N83-16342* #	NASA-TP-1786	p 191	N83-16290* #			
NAS 1.26 165770	p 227	N83-17600* #	NASA-TP-1972	p 221	N83-17560* #			
NAS 1.26 165805	p 198	N83-17523* #	NASA-TP-2033	p 216	N83-16350* #			
NAS 1.26 166053	p 238	N83-18404* #	NASA-TP-2063	p 226	N83-16528* #			
NAS 1.26 166056	p 236	N83-18304* #	NASA-TP-2080	p 232	N83-16758* #			
NAS 1.26 166155	p 206	N83-16331* #	NASA-TP-2085	p 210	N83-17535* #			
NAS 1.26 166406	p 217	N83-17533* #	NASA-TP-2092	p 209	N83-16338* #			
NAS 1.26 167874	p 214	N83-17542* #	NASA-TP-2101	p 234	N83-16951* #			
NAS 1.26 167965	p 214	N83-17543* #	NASA-TP-2110	p 225	N83-16492* #			
NAS 1.26 167966	p 214	N83-17544* #	NASA-TP-2112	p 215	N83-17547* #			
NAS 1.26 168027	p 228	N83-17728* #	NAVTRAEQUIPC-78-C-0060-9	p 220	N83-16356 #			
NAS 1.26 168029	p 233	N83-17880* #	NAVTRAEQUIPC-80-C-0132-1	p 206	N83-16334 #			
NAS 1.26 168049	p 213	N83-16343* #	NEAR-TR-274	p 213	N83-16346 #			
NAS 1.26 168050	p 238	N83-17242* #	NLR-MP-81034-U	p 209	N83-16339 #			
NAS 1.26 168067	p 190	N83-16286* #	NLR-MP-81035-U	p 209	N83-16340 #			
NAS 1.26 169736	p 238	N83-17237* #	NLR-MP-81046-U	p 207	N83-17531 #			
NAS 1.26 169737	p 238	N83-17238* #	NLR-MP-81063-U	p 236	N83-18291 #			
NAS 1.26 169749	p 190	N83-16284* #	NLR-MP-82003-U	p 234	N83-17903 #			
NAS 1.26 169750	p 226	N83-16543* #	NLR-MP-82007-U	p 234	N83-17902 #			
NAS 1.26 169751	p 225	N83-16417* #	NLR-MP-82008-U	p 207	N83-17532 #			
NAS 1.26 169755	p 205	N83-16329* #	NLR-MP-87067-U	p 228	N83-17716 #			
NAS 1.26 169828	p 236	N83-18307* #	NPS67-82-13	p 215	N83-17549 #			
NAS 1.26 169830	p 210	N83-17534* #	NRL-MR-4938	p 237	N83-18322 #			
NAS 1.26 169858	p 217	N83-17556* #	NSMRL-990	p 197	N83-16310 #			
NAS 1.26 169859	p 226	N83-17597* #	NSMRL-990	p 198	N83-16312 #			
NAS 1.26 169875	p 187	N83-17454* #	NTSB-AAR-82-13	p 197	N83-16309 #			
NAS 1.26 3439	p 190	N83-16287* #	ONERA, TP NO 1982-74	p 205	A83-23247 #			
NAS 1.26 3664	p 195	N83-17515* #	ONERA, TP NO 1982-75	p 232	A83-23248 #			
NAS 1.26 3665	p 238	N83-17239* #	OU/AEC-EER-53-5	p 210	N83-17534* #			
NAS 1.60 1786	p 191	N83-16290* #	PBB2-259003	p 226	N83-16538 #			
NAS 1.60 1972	p 221	N83-17560* #	PBB2-259144	p 220	N83-16358 #			
NAS 1.60 2033	p 216	N83-16350* #	PBB2-259151	p 220	N83-16359 #			
NAS 1.60 2063	p 226	N83-16528* #	PBB2-910413	p 197	N83-16309 #			
NAS 1.60 2080	p 232	N83-16758* #	PMA55-1-81	p 206	N83-16334 #			
NAS 1.60 2085	p 210	N83-17535* #	PML-1981-36	p 221	N83-17574 #			
NAS 1.60 2092	p 209	N83-16338* #	PNL-SA-10089	p 235	N83-18106 #			
NAS 1.60 2101	p 234	N83-16951* #	PNL-SA-9961	p 226	N83-16531 #			
NAS 1.60 2110	p 225	N83-16492* #	PWA-5512-96	p 214	N83-17544* #			
NAS 1.60 2112	p 215	N83-17547* #	PWA-5515-177	p 214	N83-17543* #			
NASA-CASE-LAR-12883-1	p 237	N83-17235* #	RAE-TM-FS(B)-483	p 202	N83-17527 #			
NASA-CASE-LEW-13639-2	p 227	N83-17683* #	RAE-TRANS-2070	p 205	N83-16326 #			
NASA-CR-159056	p 225	N83-16397* #	RAE-TRANS-2087	p 191	N83-16292 #			
NASA-CR-159252	p 216	N83-17551* #	REPT-34	p 221	N83-17562 #			
NASA-CR-159258	p 205	N83-16330* #	R80-AEG-417	p 212	N83-16341* #			
NASA-CR-159379	p 191	N83-16288* #	R81-AEG-654	p 214	N83-17539* #			
NASA-CR-159380	p 191	N83-16289* #	R82-955319-20	p 228	N83-17728* #			
NASA-CR-163109	p 214	N83-17546* #	R82AEG533	p 214	N83-17542* #			
NASA-CR-165148	p 212	N83-16341* #	R82AE511	p 212	N83-16342* #			
NASA-CR-165399	p 214	N83-17545* #	SAND-81-2577C	p 198	N83-16313 #			
NASA-CR-165582	p 214	N83-17539* #	SAR-43	p 226	N83-17597* #			
NASA-CR-165612	p 212	N83-16342* #	SR-J2-04360	p 234	N83-16814* #			
NASA-CR-165770	p 227	N83-17600* #	SU-JIAA-TR-48-PT-1	p 238	N83-17238* #			
NASA-CR-165805	p 198	N83-17523* #	SU-JIAA-TR-48-PT-2	p 238	N83-17237* #			
NASA-CR-166053	p 238	N83-18404* #	TDCK-76160	p 221	N83-17574 #			
NASA-CR-166056	p 236	N83-18304* #	TR-2101	p 187	N83-17454* #			
NASA-CR-166155	p 206	N83-16331* #	TR-81-023	p 220	N83-16356 #			
NASA-CR-166406	p 217	N83-17553* #	UDR-TR-80-37-VOL-2	p 225	N83-16402 #			
NASA-CR-167874	p 214	N83-17542* #	UDR-TR-81-14	p 225	N83-16401 #			
NASA-CR-167965	p 214	N83-17543* #	UDR-TR-82-39	p 213	N83-16345 #			
NASA-CR-167966	p 214	N83-17544* #						
NASA-CR-168027	p 228	N83-17728* #						
NASA-CR-168029	p 233	N83-17880* #						
NASA-CR-168049	p 213	N83-16343* #						
NASA-CR-168050	p 238	N83-17242* #						
NASA-CR-168067	p 190	N83-16286* #						
NASA-CR-169736	p 238	N83-17237* #						
NASA-CR-169737	p 238	N83-17238* #						
NASA-CR-169749	p 190	N83-16284* #						
NASA-CR-169750	p 226	N83-16543* #						
NASA-CR-169751	p 225	N83-16417* #						
NASA-CR-169755	p 205	N83-16329* #						
NASA-CR-169828	p 236	N83-18307* #						
NASA-CR-169830	p 210	N83-17534* #						
NASA-CR-169858	p 217	N83-17556* #						
NASA-CR-169859	p 226	N83-17597* #						
NASA-CR-169875	p 187	N83-17454* #						
NASA-CR-3439	p 190	N83-16287* #						
NASA-CR-3664	p 195	N83-17515* #						
NASA-CR-3665	p 238	N83-17239* #						
NASA-TM-76715	p 191	N83-16291* #						
NASA-TM-76970	p 205	N83-16328* #						
NASA-TM-82963	p 194	N83-17509* #						

ACCESSION NUMBER INDEX

AERONAUTICAL ENGINEERING / A Continuing Bibliography (Supplement 161)

MAY 1983

Typical Accession Number Index Listing



Listings in this index are arranged alphanumerically by accession number. The page number listed to the right indicates the page on which the citation is located. An asterisk (*) indicates that the item is a NASA report. A pound sign (#) indicates that the item is available on microfiche.

A83-19661 #	p 202	A83-20913 #	p 218	A83-22154 #	p 211	N83-16292 #	p 191	N83-17460 #	p 235
A83-19663 #	p 217	A83-20962 #	p 229	A83-22155 #	p 204	N83-16293 #	p 191	N83-17462 #	p 188
A83-19664 #	p 218	A83-21001 #	p 186	A83-22156 #	p 211	N83-16300 #	p 192	N83-17463 #	p 198
A83-19666 #	p 210	A83-21002* #	p 215	A83-22157 #	p 196	N83-16301 #	p 192	N83-17464 #	p 202
A83-19667 #	p 188	A83-21005 #	p 203	A83-22158 #	p 218	N83-16303 #	p 192	N83-17465 #	p 188
A83-19674 #	p 228	A83-21006 #	p 215	A83-22159 #	p 211	N83-16305 #	p 192	N83-17466 #	p 210
A83-19711 #	p 228	A83-21007 #	p 229	A83-22160* #	p 216	N83-16306 #	p 192	N83-17467 #	p 213
A83-19777 #	p 199	A83-21014 #	p 223	A83-22161 #	p 237	N83-16308 #	p 197	N83-17468 #	p 239
A83-19779 #	p 199	A83-21016 #	p 189	A83-22162 #	p 190	N83-16309 #	p 197	N83-17470 #	p 188
A83-19804 #	p 228	A83-21017 #	p 203	A83-22163* #	p 208	N83-16310 #	p 197	N83-17471 #	p 192
A83-19808* #	p 237	A83-21019 #	p 199	A83-22164* #	p 216	N83-16311 #	p 197	N83-17472 #	p 192
A83-19810 #	p 237	A83-21021 #	p 189	A83-22166 #	p 224	N83-16312 #	p 198	N83-17473 #	p 193
A83-19811 #	p 237	A83-21022 #	p 189	A83-22175 #	p 196	N83-16313 #	p 198	N83-17474 #	p 193
A83-19813* #	p 237	A83-21024 #	p 189	A83-22263 #	p 224	N83-16314 #	p 200	N83-17477 #	p 193
A83-19814* #	p 237	A83-21025 #	p 204	A83-22318 #	p 231	N83-16315 #	p 201	N83-17478 #	p 193
A83-19821 #	p 228	A83-21032 #	p 204	A83-22319* #	p 231	N83-16316 #	p 201	N83-17479 #	p 193
A83-19846 #	p 222	A83-21033 #	p 204	A83-22357 #	p 197	N83-16317 #	p 201	N83-17480 #	p 193
A83-19949* #	p 218	A83-21034 #	p 199	A83-22410 #	p 231	N83-16318 #	p 201	N83-17481 #	p 194
A83-20074 #	p 215	A83-21048 #	p 223	A83-22492* #	p 208	N83-16319 #	p 201	N83-17482 #	p 235
A83-20082 #	p 222	A83-21049 #	p 210	A83-22494* #	p 211	N83-16320 #	p 201	N83-17483 #	p 236
A83-20144 #	p 215	A83-21079* #	p 189	A83-22495 #	p 218	N83-16321 #	p 201	N83-17484 #	p 194
A83-20288 #	p 228	A83-21080* #	p 215	A83-22502 #	p 208	N83-16322 #	p 201	N83-17485 #	p 236
A83-20289 #	p 235	A83-21160 #	p 229	A83-22521 #	p 208	N83-16323 #	p 202	N83-17486 #	p 194
A83-20289 #	p 235	A83-21160 #	p 229	A83-22523 #	p 199	N83-16325 #	p 202	N83-17487 #	p 194
A83-20364* #	p 237	A83-21348 #	p 229	A83-22574 #	p 186	N83-16326 #	p 205	N83-17488 #	p 194
A83-20379 #	p 229	A83-21349 #	p 204	A83-22575 #	p 186	N83-16327 #	p 205	N83-17489 #	p 236
A83-20381 #	p 185	A83-21350 #	p 210	A83-22576 #	p 200	N83-16328* #	p 205	N83-17490 #	p 188
A83-20384 #	p 229	A83-21448 #	p 229	A83-22577 #	p 186	N83-16329* #	p 205	N83-17491 #	p 198
A83-20390 #	p 208	A83-21454 #	p 223	A83-22578 #	p 209	N83-16330* #	p 205	N83-17493* #	p 198
A83-20392 #	p 202	A83-21459 #	p 230	A83-22588 #	p 190	N83-16331* #	p 206	N83-17497* #	p 198
A83-20398 #	p 235	A83-21461 #	p 230	A83-22590 #	p 209	N83-16332 #	p 206	N83-17508* #	p 194
A83-20400 #	p 188	A83-21467* #	p 223	A83-22591 #	p 200	N83-16333 #	p 206	N83-17509* #	p 194
A83-20429 #	p 222	A83-21470 #	p 224	A83-22595 #	p 225	N83-16334 #	p 206	N83-17510* #	p 195
A83-20432 #	p 185	A83-21481 #	p 224	A83-22647 #	p 190	N83-16335 #	p 206	N83-17515* #	p 195
A83-20442 #	p 222	A83-21493 #	p 224	A83-22651 #	p 211	N83-16336 #	p 206	N83-17517 #	p 195
A83-20448 #	p 222	A83-21547 #	p 239	A83-22652 #	p 211	N83-16337 #	p 206	N83-17518 #	p 195
A83-20464 #	p 202	A83-21574 #	p 204	A83-22653 #	p 211	N83-16338* #	p 209	N83-17520 #	p 195
A83-20478 #	p 185	A83-21654 #	p 230	A83-22654 #	p 211	N83-16339 #	p 209	N83-17521 #	p 195
A83-20479 #	p 185	A83-21757 #	p 224	A83-22655 #	p 211	N83-16340 #	p 209	N83-17522 #	p 196
A83-20480 #	p 185	A83-21771 #	p 204	A83-22656 #	p 212	N83-16341* #	p 212	N83-17523* #	p 198
A83-20481 #	p 222	A83-21796 #	p 230	A83-22657 #	p 221	N83-16342* #	p 212	N83-17524 #	p 198
A83-20484 #	p 222	A83-21799 #	p 230	A83-22658 #	p 212	N83-16343* #	p 213	N83-17526 #	p 198
A83-20485* #	p 186	A83-21802 #	p 224	A83-22703* #	p 234	N83-16345 #	p 213	N83-17527 #	p 202
A83-20493 #	p 186	A83-21876 #	p 196	A83-22726 #	p 200	N83-16346 #	p 213	N83-17528 #	p 207
A83-20496 #	p 203	A83-21877 #	p 196	A83-22727 #	p 200	N83-16347 #	p 213	N83-17529 #	p 207
A83-20497 #	p 223	A83-21878 #	p 196	A83-22737 #	p 200	N83-16349* #	p 216	N83-17530* #	p 207
A83-20499 #	p 223	A83-22019* #	p 224	A83-22824 #	p 200	N83-16350* #	p 216	N83-17531 #	p 207
A83-20500 #	p 229	A83-22027 #	p 230	A83-22825* #	p 235	N83-16352 #	p 219	N83-17532 #	p 207
A83-20507 #	p 186	A83-22072 #	p 189	A83-22832 #	p 231	N83-16355 #	p 219	N83-17533 #	p 207
A83-20508 #	p 203	A83-22076 #	p 216	A83-22833 #	p 218	N83-16356 #	p 220	N83-17534* #	p 210
A83-20509 #	p 203	A83-22093 #	p 189	A83-22834 #	p 231	N83-16358 #	p 220	N83-17535* #	p 210
A83-20600 #	p 203	A83-22128* #	p 237	A83-22835 #	p 219	N83-16359 #	p 220	N83-17539* #	p 214
A83-20646 #	p 186	A83-22132* #	p 190	A83-22836 #	p 219	N83-16386 #	p 221	N83-17542* #	p 214
A83-20647 #	p 239	A83-22138* #	p 190	A83-22841* #	p 209	N83-16397* #	p 225	N83-17543* #	p 214
A83-20788 #	p 196	A83-22151 #	p 230	A83-22847 #	p 219	N83-16401 #	p 225	N83-17544* #	p 214
A83-20849 #	p 208	A83-22152 #	p 190	A83-22875 #	p 219	N83-16402 #	p 225	N83-17545* #	p 214
		A83-22153 #	p 190	A83-22882 #	p 209	N83-16417* #	p 225	N83-17546* #	p 214
				A83-22883 #	p 232	N83-16492* #	p 225	N83-17547* #	p 215
				A83-22886 #	p 232	N83-16528* #	p 226	N83-17549 #	p 215
				A83-22976 #	p 197	N83-16531 #	p 226	N83-17550* #	p 216
				A83-23138 #	p 225	N83-16538 #	p 226	N83-17551* #	p 216
				A83-23142 #	p 212	N83-16543* #	p 226	N83-17552* #	p 217
				A83-23149 #	p 232	N83-16553 #	p 226	N83-17553* #	p 217
				A83-23175 #	p 212	N83-16566 #	p 232	N83-17554 #	p 217
				A83-23220 #	p 204	N83-16758* #	p 232	N83-17555 #	p 217
				A83-23221 #	p 232	N83-16760 #	p 232	N83-17556* #	p 217
				A83-23222 #	p 216	N83-16765 #	p 233	N83-17558 #	p 220
				A83-23239 #	p 212	N83-16814* #	p 234	N83-17559 #	p 220
				A83-23240 #	p 219	N83-16951* #	p 234	N83-17560* #	p 221
				A83-23241 #	p 219	N83-17235* #	p 237	N83-17562 #	p 221
				A83-23247 #	p 205	N83-17237* #	p 238	N83-17564 #	p 221
				A83-23248 #	p 232	N83-17238* #	p 238	N83-17574 #	p 221
				A83-23249 #	p 205	N83-17239* #	p 238	N83-17597* #	p 226
						N83-17242* #	p 238	N83-17600* #	p 227
						N83-17246 #	p 238	N83-17609 #	p 227
						N83-17247 #	p 238	N83-17610 #	p 227
						N83-17451* #	p 187	N83-17618 #	p 227
						N83-17452 #	p 187	N83-17620 #	p 227
						N83-17454* #	p 187	N83-17621 #	p 227
						N83-17455 #	p 188	N83-17683* #	p 227
						N83-17456 #	p 188	N83-17716 #	p 228
						N83-17457 #	p 213	N83-17728* #	p 228
						N83-17458 #	p 207	N83-17748 #	p 233
						N83-17459 #	p 202		

N83-17749*ACCESSION NUMBER INDEX*

N83-17749 # p 233
N83-17759 # p 208
N83-17770 # p 233
N83-17855 # p 233
N83-17880* # p 233
N83-17899* # p 234
N83-17902 # p 234
N83-17903 # p 234
N83-18106 # p 235
N83-18291 # p 236
N83-18295 # p 236
N83-18297 # p 236
N83-18304* # p 236
N83-18307* # p 236
N83-18322 # p 237
N83-18404* # p 238
N83-18405* # p 239

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